JANUARY
1961

FOUNDRY

A PENTON PUBLICATION

Increases Yield By Using

Hollow Sprues

Page 58

How to Handle Materials with Magnets — Page 62

Cards Control Automatic Sand System — Page 65

Where Is Foundry Technology Headed? — Page 68

Automatic Pouring of Sand Castings — Page 78

CONTENTS — Pages 3-4

METALGRAMS

UNION CARBIDE METALS

. . . news of "Electromet" ferroalloys and metals

JANUARY, 1961

A LOW-COST ALLOY FOR DUCTILE IRON -- One of the fastest growing cast metals in tons produced is ductile iron. The material combines economy and good casting properties with good strength, elastic modulus, moderate toughness and good wear resistance and corrosion resistance. "EM" magnesium-ferrosilicon is widely used as the magnesium addition that produces the ductile iron structure. This economical alloy can be used in the open-ladle or plunging methods of treatment. Your Union Carbide Metals representative will be glad to help you develop efficient production techniques. Ask for F-20,069 and F-20,120.

* * *

LOW COSTS WITH CHARGE CHROME -- In recent years, the use of charge chrome in stainless steel melting has increased markedly. The reason: they are the lowest-cost ferrochromes available. Union Carbide Metals offers three alloys with different chromium, carbon, and silicon contents to meet individual practices. UCM's studies using a high-speed computer have helped steelmakers select the charge chrome that will give lowest costs. Look to Union Carbide Metals for help on the most economical use of charge chrome alloys. For more information, write for the article, "Predicting Minimum Materials Cost for Stainless Steel," in the Spring 1959 issue of UNION CARBIDE METALS REVIEW.

* * *

WHY BUY AMERICAN? -- Ferroalloy imports doubled between 1955 and 1959. Steel, iron, and nonferrous imports are up sharply too! Foreign producers have low wage rates which enable them to compete on a price basis in the U. S. However, they cannot compete with U. S. producers on three counts: (1) valuable metallurgical assistance at a user's plant, (2) consistent quality in all materials, and (3) products delivered quickly when the customer wants them. For further information, write for the article, "Why Buy American?," in the Fall 1960 issue of UNION CARBIDE METALS REVIEW.

* * *

MANGANESE IN ALUMINUM -- Manganese is used in aluminum casting alloys to neutralize the embrittling effect of iron and to increase strength. Other effects of manganese include better high-temperature properties, reduced hot shortness, improved machinability, and less chance of soldering in die casting. UCM offers low-iron ferromanganese and "Elmang" electrolytic manganese for manganese additions to aluminum. For more information on wrought and cast applications, write for the article, "Manganese Puts Muscle in Aluminum," in the Winter 1961 issue of UNION CARBIDE METALS REVIEW.

* * *

BETTER MACHINABILITY -- Polls of gray iron castings users have indicated that they rate good machinability as "extremely important." Foundrymen are improving the machinability of their castings by inoculating iron in the ladle with "SMZ" alloy. This strong graphitizing inoculant eliminates chilled corners and edges that cause excessive tool wear and breakage in the machine shop. As much as 25 per cent faster machining rates have been reported. Only 2 to 4 lb. of "SMZ" alloy per ton generally eliminate chill. Further facts can be obtained by writing for a 16-page booklet, F-4604C.

* * *

UNION CARBIDE METALS COMPANY, Division of Union Carbide Corporation, 270 Park Ave., New York 17, N. Y. In Canada: Union Carbide Canada Ltd., Toronto.

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How to control casting quality:

use quality-controlled alloys from Reynolds Aluminum

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Chicago 22, Illinois

Sonken-Galamba Corporation
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Kansas City, Kansas

Nathan Trotter & Co., 36 N. Front Street, Philadelphia 6, Pa.

One good way to be sure of uniformity and high quality in your aluminum castings is to be sure of the quality of the ingot you use. Many foundries have solved their quality-control problems by using Reynolds Aluminum ingot along with Reynolds technical and consulting services. (You get *more* than metal when you buy from Reynolds.) High standards, painstaking production and inspection methods all assure the consistent high quality of Reynolds casting alloys.

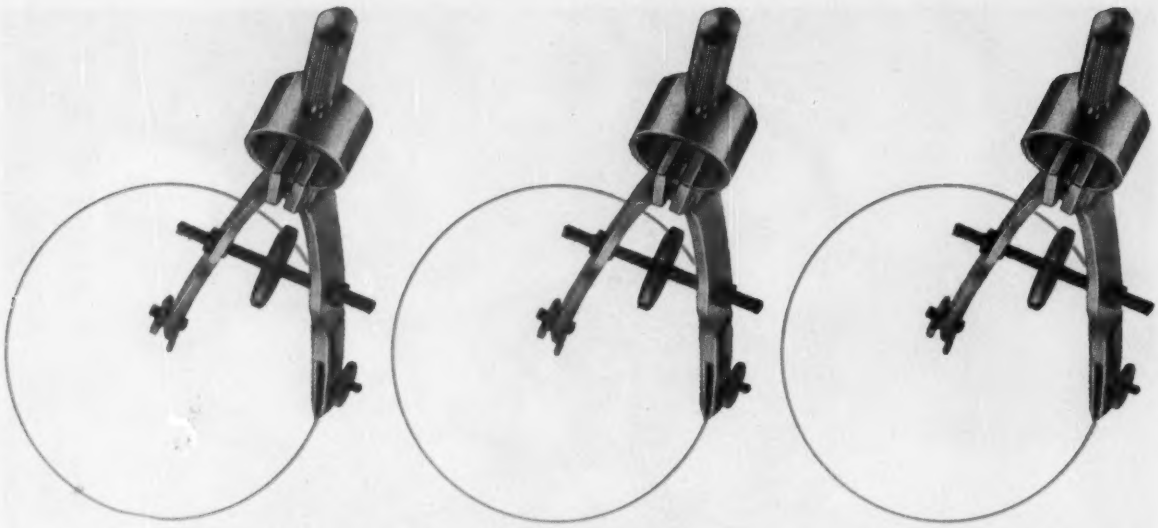
In addition to the large stocks of casting alloys maintained at our producing plants—Jones Mills, Arkansas and Troutdale, Oregon—an important part of Reynolds service to the foundry industry is a nation-wide network of ingot distributors whose extensive stocks are even closer to you. *Reynolds Metals Company, P.O. Box 2346-FK, Richmond 18, Virginia.*

REYNOLDS ALUMINUM

Watch Reynolds new TV Show "Harrigan & Son", Fridays; also "All Star Golf", Saturdays—ABC-TV.

The Finest Products Made with Aluminum are made with REYNOLDS ALUMINUM

Circle 553 on Page 39



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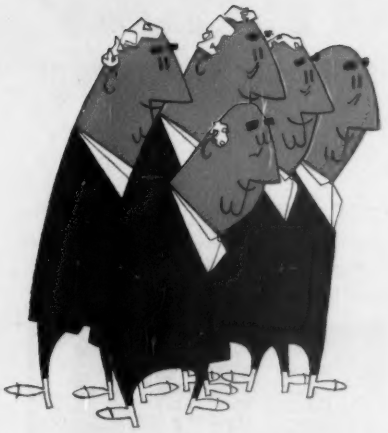
Circle 554 on Page 39

January 1961
Volume 89—Number 1

FOUNDRY
A PENTON PUBLICATION



This group of earnest-looking men actually represents only a small part of the authorities who present their views in this issue on major trends in foundry technology and education. Their comments start on p. 68.

Let's Do Both 57
By WILLIAM G. GUDE

Increases Yield by Using Hollow Sprues 58
Hollow sprue technique for investment molding increases casting yield as much as 300 per cent. It is one in a series of technological advances made by Precision Metalsmiths Inc., Cleveland—By ROBERT H. HERRMANN

Handling Materials with Magnets 62
I-F Mfg. Co., New Philadelphia, Ohio, makes extensive use of bridge cranes equipped with lifting magnets to handle metal and castings in the melting, cleaning, and heat treating departments—By ROBERT H. HERRMANN

Cards Control Automatic Sand System 65
Use of punched cards for automatic sand preparation has proved successful at Ford Motor Co.'s English foundry. The system produces one ton of core sand every three minutes—By LEO WALTER

Foundry Technology—Where Is It Headed? . . 68
Results of a survey of 22 research men and educators to determine their beliefs about current and future developments in foundry technology and education are presented in this thought-provoking article

Automatic Pouring of Aluminum Sand Castings 78
Automatic pouring and an unusual melting setup are features of an aluminum sand casting line at Pontiac Motor Div., GMC, which produces timing chain covers. Aluminum blocks and heads also are possible—By JACK C. MISKE

Risering of Malleable Iron 82
In our 16th article on gating and risering castings, the authors discuss risers for malleable iron castings. Shapes, sizes, locations, and other factors are covered—By HANS J. HEINE and ROBERT A. PEACOCK

The World of Cast Metals 23

Aluminum Casting Process Being Licensed in U. S. 23
Ford To Install New Dust Control Unit in Cleveland 23
New Alloy Used on Nuclear Powered Submarines 23
Ductile Iron Group Holds Meetings 26
Steel Founders' Society Makes Safety Awards 26
FEF Extends Scholarship Program 29

Sand—the Molding Tool 108
Each ferrous and nonferrous metal requires different molding sand. The author discusses types of sand for each metal and explains how to prepare them in the third of a series of six articles on sand—By W. P. WINTER

Investment Casting Institute Meets 121
By ROBERT H. HERRMANN

CONTINUED NEXT PAGE

Editor: WILLIAM G. GUDE
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CONTINUED FROM PAGE 3

Carves in Sand in Statuary Molding Process . . 126
Canadian sculptor carves statues in sand and uses them for patterns and cores to make molds for metal castings—By ART PRICE

Man to Man 134
There is just as much or more skill hidden away in a thoroughly mechanized foundry as in foundries of the past—By RALPH L. LEE

Michigan Regional Foundry Conference 138
By EDWIN BREMER

Dust Collector Helps To Cut Smog 153
Installation meets air pollution requirements and also creates better working conditions at Dayton Foundry, Los Angeles—By DAVID PERLIS

The Sandman Says 160
Like lemonade, sand mixes are inconsistent in nature. They combine ingredients with completely opposing properties—By HAROLD E. HENDERSON

Malleable Founders' Semiannual Meeting 164

Electric Furnace Conference 166
By EDWIN BREMER

Diecasting Congress Technical Reports 171
Here are resumes of all 31 papers presented at the first National Die Casting Exposition and Congress, held in Detroit, Nov. 8-11. They cover die design and building, metallurgical developments, vacuum diecasting, etc.

International Foundry Congress Reports 182
By M. M. HALLETT

In Every Issue

Around the Country	147	Men of Industry	187
Calendar of Meetings . . .	35	Obituary	194
Equipment and Supplies . .	95	Patents of Interest	156
Foundry Developments . . .	124	Questions and Answers . .	90
How To Do It	118	Readers' Comment	51
Industry Briefs	117	Statistics	17
Late News	17	The Shakeout	196
Literature for Foundrymen .	142	With the Editors	10

Classified Advertising—206 Advertisers' Index—214 Business Staff—215

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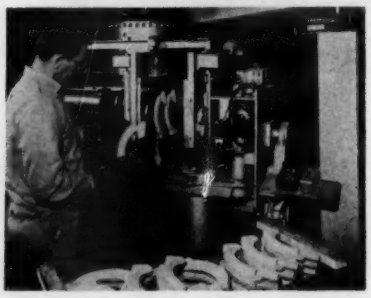
THE EDITORS' WORKSHOP

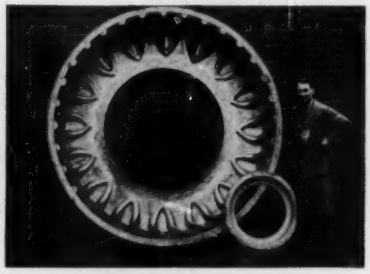
CONVERSIONS: When Canton Malleable Iron Co., Canton, Ohio, launched a $300,000 plant improvement program, it also adopted a new



sales approach—one based on converting products of other materials to castings. How the company went about this task is detailed by Associate Editor Bob Herrmann in an article next month.

NEWS: Starting with this issue you'll find it easier to scan the news of the foundry industry. Our "Late News" insert starts on Page 17 instead of 33 as formerly. A rearrangement of some editorial pages now groups many news items in a new department titled "The World of Cast Metals." It starts on Page 23, and we hope you like it.

CLOSE TOLERANCES: Production of accurate castings is not just a matter of adopting a certain molding process, says John Armstrong, Sterling Metals Ltd., Nuneaton, England. It also requires close at-



tention to detail, practical knowledge, and common sense, he maintains. His article, "Close Tolerance Light Alloy Castings," to be presented, next month discusses these requirements.

Circle 555 on Page 39→

Blunt way to ask for an order? Perhaps, but we believe in the direct approach. In fact, that's the way we deal with all of our customers. *We sell direct*—strictly a furnace-to-foundry operation. But buying direct is just one of the advantages you have when you get your pig iron from our furnaces at Cleveland, Ohio. Another, and equally important advantage is that you will be dealing with an organization whose plant is designed for and devoted exclusively to the production of *merchant* pig iron. As a customer, you have access to an almost unlimited storehouse of United States Steel's metallurgical and technical knowledge. *If you have any problems pertaining to foundry operation, our Foundry Service Metallurgist can undoubtedly help you solve them.* Incidentally, American Steel & Wire does not allocate a single pound of its merchant pig iron output to any United States Steel mill. *All of it is for sale!* American Merchant Pig Iron is produced in one of the industry's largest and most modern plants. It is carefully made from selected raw materials under highest standards of quality control. It features a minimum of "tramp element" contamination; has uniform, well distributed graphite content, and a full percentage of desired elements. You can get American Merchant Pig Iron in 35-lb. pigs . . . in any wanted grade: Basic, Foundry, Malleable, Bessemer, Intermediate and Low Phosphorous, including Low Manganese for Ductile Iron Casting.

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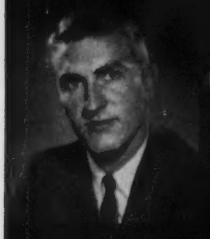

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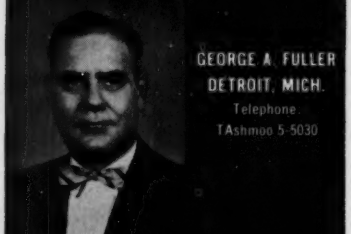

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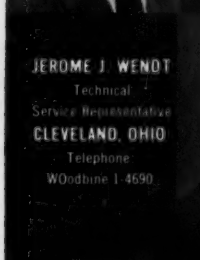

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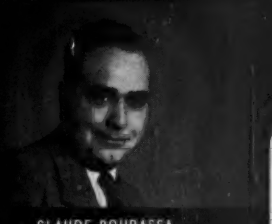

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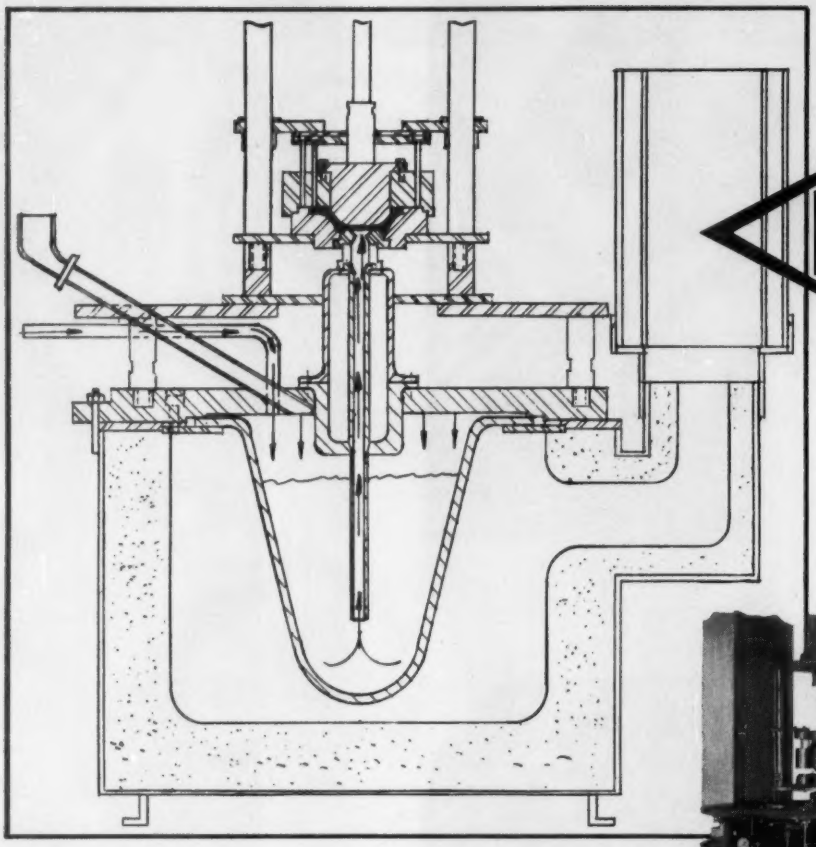
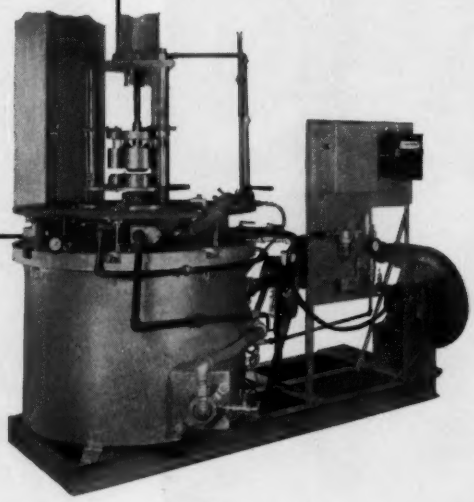




PMD

What our experience means to you in . . .

LOW PRESSURE CASTINGS

Low pressure casting is occupying an important place in the metallurgical industries as a major development in the technique of permanent mold casting. The success of this type of casting is due, in part, to the technical knowledge and manufacturing skill of the personnel at Permanent Mold Die Company. Their experience makes it possible for PMD to offer you the finest quality low pressure casting machines available. These machines assure close tolerances and reduced trimming operations.

The PMD low pressure casting process deviates from the standard method only in the introduction of the metal to the mold. The mold is placed above a pressurized, airtight furnace; the molten metal is then forced through a tube into the mold from below. Pressure is held just long enough for the metal in the mold cavity to solidify, then it is released, allowing the excess metal to flow back into the molten bath.

It is obvious that the gating system can be simplified and the risers can be reduced to a minimum. These PMD machines greatly increase the ratio of net casting to the amount of metal poured. This results in a substantial reduction in production costs.

Write today for more detailed information about PMD automated molding machines and the savings they can mean to you.

FINISHED PRODUCT OF ABOVE DIAGRAM

This ashtray is an aluminum casting made from the PMD low pressure casting machine shown above.

PMD

PERMANENT MACHINE DIVISION

A Subsidiary of Permanent Mold Die Co.

2275 E. 9 MILE RD. • WARREN, MICHIGAN

This belt lived 3 lives before accident killed it off

THE conveyor belt previously used in this foundry lasted only a year, had to be repaired frequently. The intense heat blistered and scorched it, hardened and cracked the rubber.

When a B.F.Goodrich distributor heard of the problem, he recommended a BFG belt that was specially developed for carrying hot materials. This belt is made with a heat-resisting rubber that can stand temperatures that char or burn ordinary rubber belts.

The B.F.Goodrich hot-material belt lasted three years—two years longer than the belt it replaced. Even then, it was an accident, not heat prostration, that killed it off. As the head of plant maintenance put it: "No one knows how long this belt might have lasted if it hadn't been accidentally ripped."

In this foundry, the purchasing agent had a good rule. Instead of accepting the high cost of frequent replacements, he called in a BFG distributor and found exactly what he needed to keep the plant running with fewer shutdowns and delays.

Your B.F.Goodrich distributor has the exact specifications for the belt described here. And, as a factory-trained specialist in rubber products, he can answer your questions about the many products B.F.Goodrich makes for industry. *B.F.Goodrich Industrial Products Company, Dept. M-943, Akron 18, Ohio.*

B.F.Goodrich

CONVEYOR BELTS

Circle 558 on Page 39

ONE OPERATOR DUMPS MOLDS EASILY

at Fahralloy Co., Harvey, Ill.

ONE MOLD DUMP SERVES 4 CONVEYOR LINES

Nomad's *movable* Mold Dump runs on transfer track to service four lines of Nomad 2-Level Track Conveyors. This unit elevates and dumps into a bucket on a transfer car, as shown, which carries away sand and castings for separation. This same unit can dump over a wall, into a bin or front-end loader, or into a floor-mounted oscillating conveyor. Since dumping is effortless and takes but a fraction of the working day, the operator is free for other duties.

After dumping, the dump returns to conveyor level ready for the next load — at the same line or another.

FAST DUMPING

A short dumping cycle and easy operation help increase production.

All Nomad Dumps are sturdily built to handle a wide range of mold and flask sizes. Stationary units are also available.

Write Today NOMAD EQUIPMENT *for information on fast, easy dumping and other mold handling devices.*

NOMAD EQUIPMENT CORPORATION
3110 W. FOND DU LAC AVE., MILWAUKEE 10, WIS.

Circle 559 on Page 39

With the Editors

A RECORD: An event of special interest took place during the semi-annual meeting of the Malleable Founders' Society in Cleveland, on Dec. 2. After the members were seated at lunch, Charles P. Speitel, Pennsylvania Malleable Iron Corp., Lancaster, Pa., and society president, arose with the following remarks:

"We have a very special guest with us today. We would like to pay tribute to a man who has served this industry all his life. Sixty years ago this fall, William V. Osborne, president of Lakeside Malleable Castings Co., Racine, Wis., as a teenager, attended a meeting of the American Malleable Castings Association in Buffalo. That meeting happened to fall on the day that President McKinley was assassinated right there in Buffalo. Mr. Osborne was accompanying his father who was president of Wisconsin Malleable and interested in Lakeside.

Charles P. Speitel, left, congratulates William V. Osborne

"In 1905, 55 years ago, Mr. Osborne began his active career in the malleable iron industry, and is still going strong. In honor of this occasion, I have asked the waiters to pour champagne for everyone, and when this is completed, Lowell Ryan will propose a toast."

I would like to add my sincere congratulations to this fine gentleman, whom I have had the pleasure of knowing for many years.

Of Value: Early in November, the *Wall Street Journal* carried an article headed "Executive Reading—More Trade Journals Fight for Boss' Time, Advertising Outlays." The article started as follows: "Chicago —Flipping through a heap of magazines on his desk, tall, bespectacled L. D. McDowell bends down to count a few more in his wastebasket. 'I must be getting nearly 80 magazines here every month,' he says, with a surprised air. The figure is all the more surprising because Mr. McDowell is not a librarian or engaged in literary pursuits, but is chief works engineer of American Steel Foundries, a maker of railroad car parts."

After reading this article, I asked the girls in our circulation department if Mr. McDowell was on our list to receive FOUNDRY, and they assured me that we do not miss sending our publication to such important people as chief engineers of foundries.

With this information, I just could not resist taking the pen in hand and asking Mr. McDowell if FOUNDRY was one of those relegated to the wastebasket, or if it served a purpose. His reply gave us such a lift that I want you to read it:

"You may relax your concern, Mr. Steinebach, as to whether publications of *value* wind up in the wastebasket. I never miss an issue of FOUNDRY or *Steel* magazine nor haven't for many years. All members of our Engineering Department, likewise, include these in their regular reading schedule."

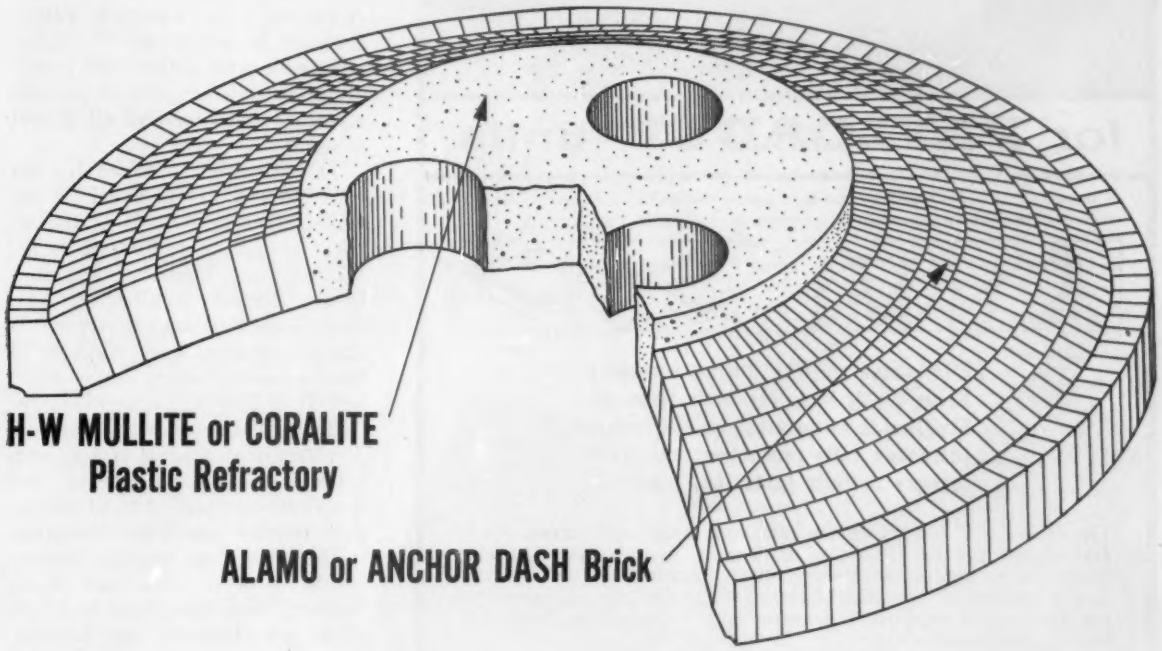
Thank you, Mr. McDowell. Your letter gave the editors of FOUNDRY and of *Steel*, our sister publication, a big lift.

Furfuryl Alcohol: Considerable interest has developed in furfuryl alcohol as a base for a sand binder. A real good report on the subject, the first to be presented to the foundry industry, was published on Page 128 of the August issue of FOUNDRY. You can expect additional articles soon.

Ad-Gage: On other occasions this column has mentioned our Ad-Gage readership studies to determine the impact of both editorial and advertising pages on our readers. These

ELECTRIC FURNACE ROOF LIFE IMPROVED

with combination Harbison-Walker Monolithic and Brick constructions



In electric steelmelting furnaces, roof life in comparison with that of the walls and bottom is very important in the overall furnace economy. The center section of the roof is exposed to the most severe treatment, costs most to install in time and money and is most difficult to build with the best workmanship.

When temperatures and other factors of operation and construction exceed those for which silica brick serve best, Harbison-Walker superduty fireclay and high-alumina brick are selected to provide the needed margin of durability for best results.

H-W MULLITE PLASTIC REFRACTORY and CORALITE PLASTIC REFRACTORY used for the monolithic center sections are physically and chemically compatible with these classes of brick and by fortifying this portion of the roof, the best balance in service life is achieved. These plastic refractories possess the most desirable working properties for easiest installation with freedom from forming defects. At operating temperatures, a strong ceramic bond with negligible volume change is developed. Other properties which contribute to their exceptional durability are high density with low permeability and unusually good spalling resistance.

H-W MULLITE PLASTIC REFRACTORY (70% alumina) in relation to serviceability of annular brick rings and the monolithic center section, closely corresponds to the superduty fireclay brick brands of ALAMO (Mo.), H-W SUPER SAVAGE (Md.), DEAN (Pa.), BOONE (Ky.), H-W KALA (Ala.) and ZENITH (Cal.) and ANCHOR DASH 60% alumina brick.

CORALITE PLASTIC REFRACTORY (80% alumina) generally is used with greatest benefit for high temperature operations with ALUSITE brick of 70% alumina content and others containing higher percentages of alumina, in furnaces producing high temperature alloys.

Roofs of smaller furnaces for some conditions are built entirely with these plastic refractories with considerable improvement in service.

Comparative data based on experiences at many different plants involving considerable tonnages of these high-alumina plastic refractories clearly illustrate their superiority for this application. Write for further information.

HW60-32

HARBISON-WALKER REFRACTORIES CO.

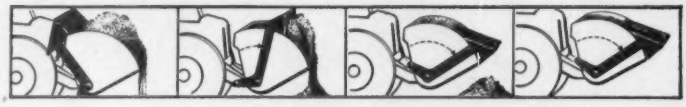
And Subsidiaries General Offices: Pittsburgh 22, Pa.

World's Most Complete Refractories Service

New NO-SPILL Bucket

for PAYLOADER® units

A strikerbar-spillguard blade, by hydraulic power, sweeps forward removing excess material. Blade remains forward in transport to retain load.



. . Eliminates spilling during transport
. . Saves costly floor and aisle clean-up
. . Eliminates re-working spilled material
. . Increases daily productive capacity
. . Delivers uniform loads for "batching"

The "No-Spill" bucket is the latest of many PAYLOADER *firsts*, and makes the tractor-shovel a cleaner, more productive and more efficient materials mover than ever before. Its two features — the striking-off of excess material while loading, and preventing any loss of load while transporting — give many on-the-job savings and benefits:

1. Permits higher transport speeds for more trips and more production.
2. Delivers bigger loads as none is lost in transit.
3. Eliminates the dust nuisance caused by light, dry materials spilling in transit.
4. Prevents the accumulation and build-up of spillage along aisles — saves the cost and time of digging up and reprocessing such spillage.
5. Eliminates the contamination and waste involved when different materials are spilled on the same routes.

Three popular PAYLOADER sizes can be supplied with "No-Spill" buckets — the Models HA, H-25 and HAH. Your Hough Distributor will be happy to show you what they can do to improve materials moving efficiency on your operations. See him today.

HOUGH®

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☐ Send data on No-Spill bucket
☐ Send data on other rubber-tired "PAYLOADER" models

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Title _____
Company _____
Street _____
City _____
State _____

1-A-2

studies, made four times a year, are possible because 200 or more of our readers take the time to mark up a copy and return it to us for tabulation. May I thank everyone who has complied with our request for this information, and ask you to participate if you should receive such a request in the future.

Wide Reading: The Ad-Gage survey results, covering the editorial material in the September issue, provide several interesting bits of information. I was rather surprised that a nontechnical article, "Impact of Educational Trends of the Foundry Industry," by Howard F. Taylor, professor of metallurgy, Massachusetts Institute of Technology, proved of greatest interest, with 50 per cent reporting that they read all or part of it.

This article was followed in order by "Factors To Consider When Buying Castings," by Louis Iannettoni, Motors and Controls Div., Westinghouse Electric Corp., Buffalo; "Revised Specifications for Gray Iron Castings," a report on ASTM activities; and "Methods of Demonstrating Casting Techniques," by J. B. McIntyre, National Foundry College, Wolverhampton, England. The fact that readers picked such subjects as education, selling, and specifications ahead of those dealing with practice was quite interesting.

The most four popular departments, in order, were Late News, Editorial, New Equipment and Supplies, and Questions and Answers.

Kind You Want: Warren W. Brown, manager, market development, Massillon Steel Casting Co., Massillon, Ohio, has sent along a recently published promotion booklet having the interesting title of "The Kind of Steel Castings You Want WHEN You Want Them." It represents a well prepared job, giving important information on facilities, types and sizes of castings produced, price, and the various types of manufacturers which Massillon serves. This book should be a good sales tool.

Happy New Year: As we enter the new year, the editors of FOUNDRY extend their wishes for a happy and prosperous 1961 for the foundry industry.

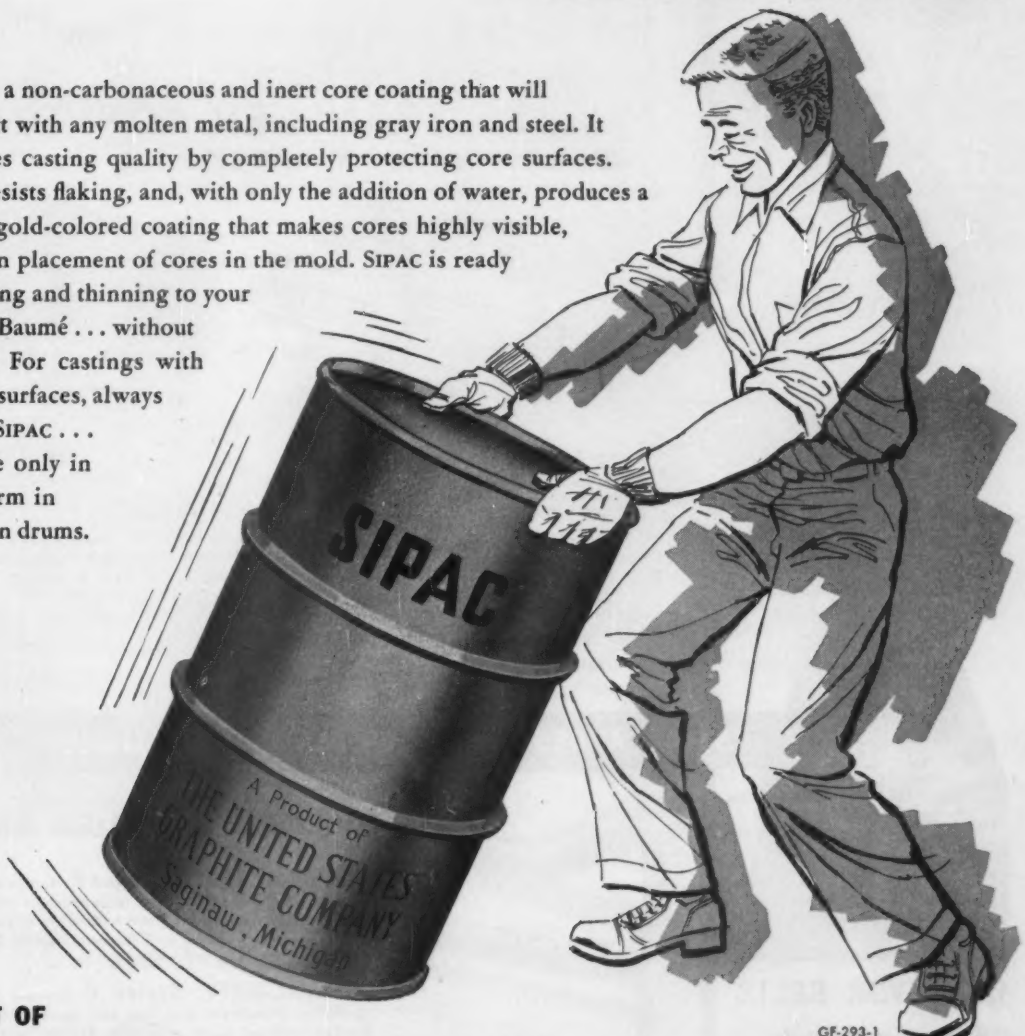
F.G.S.

For Improved Casting Quality

"ROLL OUT THE ~~BARREL~~ (DRUM)"

OF SIPAC®

SIPAC is a non-carbonaceous and inert core coating that will not react with any molten metal, including gray iron and steel. It improves casting quality by completely protecting core surfaces. SIPAC resists flaking, and, with only the addition of water, produces a bright, gold-colored coating that makes cores highly visible, aiding in placement of cores in the mold. SIPAC is ready for mixing and thinning to your desired Baumé . . . without settling. For castings with smooth surfaces, always specify SIPAC . . . available only in paste form in 55 gallon drums.



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DIVISION OF THE WICKES CORPORATION, SAGINAW 14, MICHIGAN

GRAPHITAR® CARBON-GRAPHITE • GRAMIX® POWDER METALLURGY • MEXICAN® GRAPHITE PRODUCTS • USG® BRUSHES

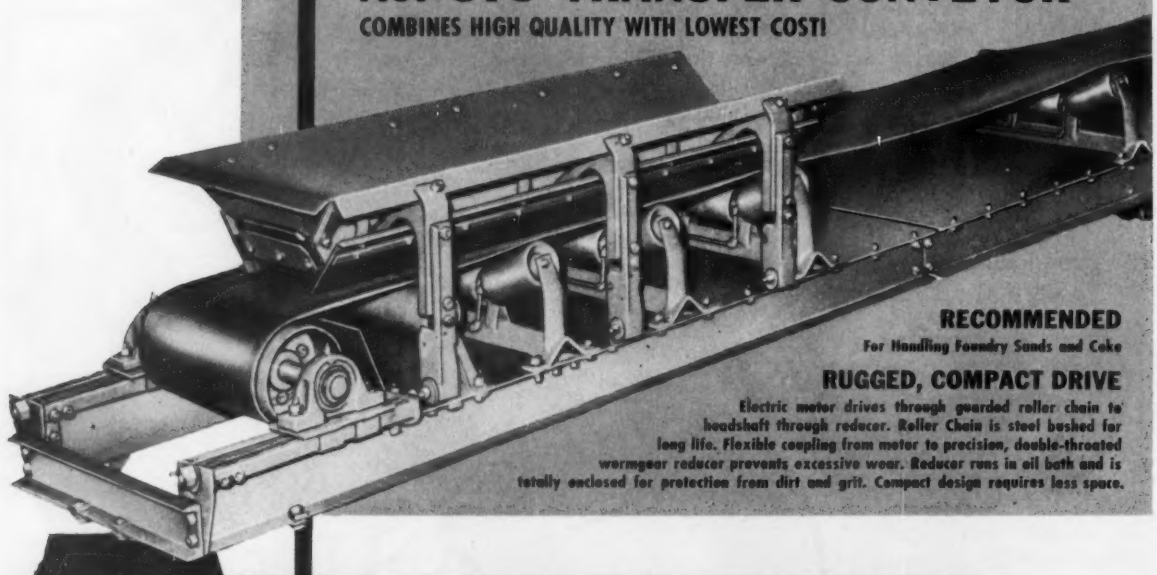
Circle 562 on Page 39

NOW... C&S offers

Stock Standard Conveyors for Quick, Simple Installation in all Foundries!

No. 375 TRANSFER CONVEYOR

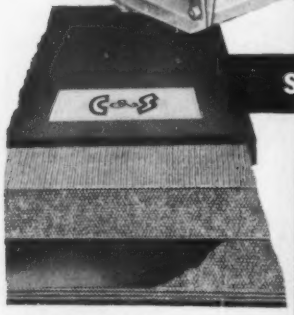
COMBINES HIGH QUALITY WITH LOWEST COST!



RECOMMENDED
For Handling Foundry Sands and Coke

RUGGED, COMPACT DRIVE
Electric motor drives through guarded roller chain to headshaft through reducer. Roller Chain is steel bushed for long life. Flexible coupling from motor to precision, double-throated wormgear reducer prevents excessive wear. Reducer runs in oil bath and is totally enclosed for protection from dirt and grit. Compact design requires less space.

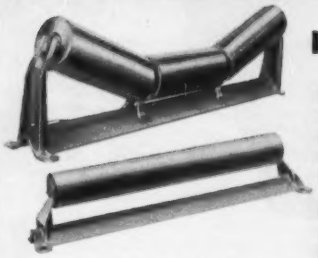
STOCK ACCESSORIES FOR ALL INSTALLATIONS



CONVEYOR BELTS

Low Cost . . . Longer Life Through Superior Design

- Stocked in 18", 24", 30" and 36" widths.
- Available with standard or heat-resistant covers.
- 4-5-6 ply.



All Sizes and Types Stocked for prompt shipment. Manufactured to CEMA specifications, and are generally interchangeable replacements for existing foundry belt conveyors.

IDLERS and RETURN ROLLERS

PERMA-GREASED, Series P—Factory-sealed for years of maintenance-free service. Ideal for installations where greasing is difficult and continuous service with moderate loads and belt speeds is required. Available with 4" or 5" diameter rolls for 18" through 48" belt widths. Precision ball bearings.

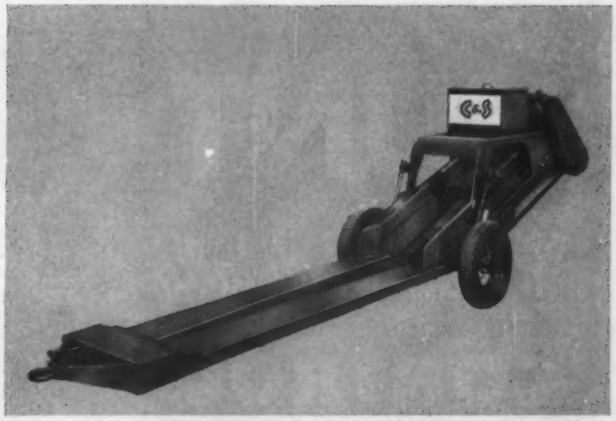
NORMAL-DUTY, Series C—Designed for continuous service with moderate loads and belt speeds. Recommended for handling sands and smaller aggregates. Available with 4" or 5" diameter rolls for 18" through 48" belt widths.

HEAVY-DUTY, Series D—For continuous and high-speed handling of heavy sand loads and larger aggregates. Rugged tapered roller bearings. Available with 5" or 6" diameter rolls for 18" through 60" belt widths.

SPECIAL IDLER CATALOGUE AVAILABLE UPON REQUEST

STOCK Foundry Conveyors and Accessories in Pre-Engineered Units and Standard Sizes for . . .

- **NEW INSTALLATIONS**
- **ALTERATIONS**
- **MAINTENANCE**

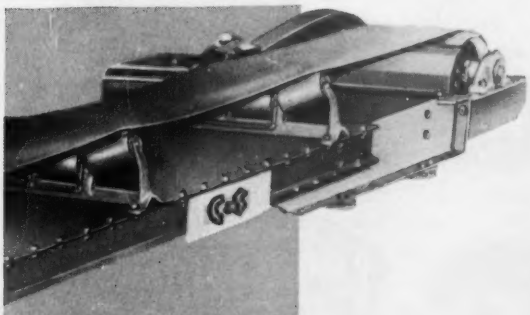


MODEL 358 HOPPER CAR UNLOADER

FOR FOUNDRY SANDS, COKE AND LIMESTONE

- Unloads Cars in 45 Minutes
- Easy One-Man Operation
- Operates Above Rails and without Pits
- Rugged, Heavy-Duty Construction. Handles Materials up to 150 lbs. per cu. ft.

Available with electric or gasoline motor drives.



COMPLETE FACTORY ASSEMBLED SECTIONS FOR EASY INSTALLATION

STOCK SIZES:

Belt Widths: 18", 24", 30"

Lengths: 9-ft. to 102-ft. in 1-ft. Increments

Other C & S Equipment Includes:

"MIXALL" Shell Sand Coating Plants
"HEATALL" Sand Heating Units
"PUGALL" Sand Mixing Equipment
"BLO-CORE" Automatic Shell Blowing Machines
Bucket Elevators & Ship Hoists
Sand Weighing & Feeding Systems

PORTABLE YARD CONVEYORS

FLEXIBILITY WHERE YOU NEED IT MOST
FOR FOUNDRY SANDS & COKE

MODEL 362: 100 T.P.H.—18" Belt Width
Standard Lengths: 20', 25' & 30'

MODEL 363: Up to 200 T.P.H.—24" Belt Width
Standard Lengths: 25', 30' & 35'

NOTE: All models available with electric, or gasoline Power Units.

"Constant Quality through Constant Control"

Write Today for Bulletin CS-161

C & S PRODUCTS COMPANY, INC.

Engineers and Builders of Automatic Foundry Equipment

18656 FITZPATRICK DETROIT 28, MICHIGAN

AFFILIATED WITH Barber-Greene

Circle 563 on Page 39

HUNT

Air and Hydraulic

CONTROL VALVES

Whatever the application . . . whatever the service . . . whatever the pressure range . . . whatever the size . . . whatever the actuation required . . . chances are you'll find a valve in the Hunt line *exactly* suited to your needs.

Sizes range from ⅛ through 8 in. for vacuum to 300 psi air and for water, soluble oil and water, or oil to 5000 psi.

Your nearby Hunt representative will be pleased to work with you. You'll find him listed in Sweet's Product Design File.

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QUICK-AS-WINK© AIR AND HYDRAULIC

VALVES

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For more information, write for Bulletin 603. Address Dept. FO-161, Hunt Valve Company, Salem, Ohio.

3001

Late News

OUTLOOK: Foundrymen say they expect to ship 4 to 5 per cent more tons of castings during the coming year than they did in 1960. This estimate is derived from *Foundry's* questioning of several thousand foundries about the business outlook. Here are high lights of the study:

- Increased shipments are expected by 45 per cent of all foundries; 40 per cent look for no change, and 15 per cent anticipate a decrease.
- Gray iron and steel foundries forecast a 3 to 4 per cent upturn, malleable foundries expect a 4 to 5 per cent rise, and nonferrous shops see a 5 to 6 per cent gain.
- Small foundries are more optimistic about 1961 than are the large producers.
- Conditions will improve as the new year progresses; 94 per cent of all foundries expect the second half to be equal to or better than the first six months.
- About 63 per cent of all foundries plan to replace equipment or make other capital improvements during 1961.

TRENDS: Mixed trends are forecast by businessmen and economists for the major indexes which make up the business picture. The consensus for 1961 calls for declines in expenditures for new plant and equipment, automobile production, and consumer spending for durable goods. Upturns are expected in total personal income, retail sales of soft goods, exports, home building, and public spending. Total gross national product this coming year is placed at $510 to $515 billion, about 2 per cent higher than in 1960.

Passage of a large number of bond issues

Foundry Statistics

Iron and Steel Scrap Consumption

(Gross tons*)

	All Scrap Total	By Types of Furnace — Cupola Total	Air Total	Electric Total
1958	50,242,746	7,725,970	821,388	7,152,726
1959				
Aug.	1,875,165	691,786	51,134	374,678
8 mo.	42,780,391	6,555,629	756,367	6,536,053
Sept.	2,114,015	801,588	99,090	441,134
Oct.	2,266,709	798,569	98,279	445,137
Nov.	4,796,896	814,233	82,784	801,555
Dec.	7,021,870	843,040	99,577	1,008,158
Total	58,979,881	9,613,059	1,156,097	9,232,037
1960				
Jan.	7,043,488	823,442	95,442	1,058,159
Feb.	6,493,558	822,476	97,688	1,015,716
Mar.	6,655,569	839,016	106,749	974,535
Apr.	5,625,717	754,486	82,767	787,186
May	5,051,121	771,800	79,170	852,585
June	4,485,444	809,297	87,485	633,797
July	3,678,127	603,062	55,974	520,361
Aug.	4,217,562	692,470	78,788	692,471
8 mo.	43,250,586	6,116,049	684,063	6,234,810

Index of Foundry Equipment Orders

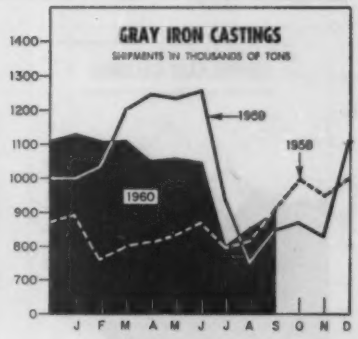
Foundry Trades Only

(Net Orders Closed, New Equipment)

	1959	1960
Jan.	127.4	92.5
Feb.	237.1	123.6
Mar.	166.6	159.9
Apr.	154.2	97.9
May	157.0	150.0
June	125.1	164.8
July	110.7	80.0
Aug.	134.1	92.4
Sept.	131.3	154.1
Oct.	140.8	81.7
Nov.	151.2	....
Dec.	95.9	....

Note: Base period 1947-49 taken as 100 per cent monthly average.

Source: Foundry Equipment Manufacturers Association.



GRAY IRON CASTINGS—SHIPMENTS

(Net tons[2])

	All Castings — Total	All Castings — For Sale	Miscellaneous Castings Total	Miscellaneous Castings For Sale	Nodular Iron Castings Total	Heavy Steel Ingot Molds Total	Chilled Railroad Car Wheels Total	Pressure Pipe & Fittings Total[3]	Soil Pipe & Fittings Total[3]	Unfilled Orders[3]
1958	10,357,504	5,849,426	6,146,186	2,645,005	117,558	1,884,396	265,114	1,277,685	784,123	.....
1959										
Sept.	849,379	527,449	595,149	279,069	12,355	19,416	16,272	142,660	75,882	884,185
9 mo.	9,497,974	5,374,535	5,686,117	2,448,348	123,866	1,663,075	252,980	1,112,942	682,866	.....
Oct.	870,635	519,178	621,833	277,161	17,797	20,155	19,647	139,716	69,284	886,970
Nov.	830,369	514,888	492,742	249,576	12,698	165,139	16,723	96,086	59,670	885,368
Dec.	1,106,796	583,571	649,200	270,276	14,651	294,129	20,595	92,139	50,733	845,575
Total	12,305,765	6,992,172	7,449,892	3,245,361	169,012	2,142,498	309,945	1,440,883	861,147	.....
1960										
Jan.	1,135,575	591,804	677,392	277,100	16,774	295,994	13,463	86,793	58,928	851,336
Feb.	1,107,721	571,143	675,927	279,190	16,430	284,738	17,848	76,332	49,876	855,324
Mar.	1,143,395	600,162	685,102	284,207	15,670	294,322	24,409	83,121	56,441	880,132
Apr.	1,051,357	580,590	609,234	258,994	13,980	232,895	21,737	118,886	68,605	834,495
May	1,052,798	588,770	613,745	257,180	13,126	207,094	20,414	136,455	75,090	781,566
June	1,049,638	601,597	622,236	273,148	15,010	183,049	19,810	144,773	79,770	719,564
July	803,306	459,540	478,269	202,347	10,694	120,784	16,226	120,652	67,375	764,789
Aug.	858,503	540,395	490,059	238,561	15,675	131,428	14,221	139,275	83,520	712,784
Sept.	900,497	527,227	554,788	245,887	14,616	125,558	13,460	135,327	71,234	695,325
9 mo.	9,102,790	5,052,268	5,409,752	2,316,614	131,975	1,875,992	166,588	1,041,619	608,839	.....

*Source: U. S. Dept. of Interior Bureau of Mines. [2]Source: Bureau of Census. [3]For sale only. [4]All cast iron pipe is shipped for sale. [5]Gray iron total includes nodular iron.

Late News

this fall for public projects will boost spending by state and local governments for public works, schools, and highways. Much of this work will mean business for foundries.

FIELD SECRETARY: Gray Iron Founders' Society has appointed Benjamin J. Imburgia as its field secretary. For the last three years he was manager of the Better Business Bureau, Norfolk, Va.

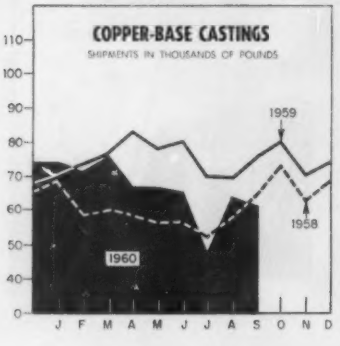
DEPRECIATION: Adoption of more realistic tax laws affecting depreciation of industrial equipment appears likely to be considered early in the next session of Congress. Favorable action should give a boost to industry's capital expenditures. A study by the Research Institute of America shows that most businessmen will be encouraged to expand their facilities if depreciation allowances are liberalized.

MATERIAL HANDLING: Sales of material handling equipment in 1961 will total about $610 million, 2 per cent ahead of the 1960 volume. It will be the industry's third best year. This is the prediction of Robert F. Moody, general sales manager, Hyster Co., Portland, Oreg., who was elected president, Material Handling Institute, at its recent annual meeting. Other new officers are Bert E. Phillips, Industrial Truck Div., Clark Equipment Co., Battle Creek, Mich., first vice president, and Norman A. Price, Colson Corp., Chicago, second vice president.

OBITUARY: J. W. Tiscornia, president, Auto Specialties Mfg. Co., St. Joseph, Mich., died Dec. 16 . . . Calbraith P. Champlin, president and treasurer, Strong Steel Foundry Co., Buffalo, died Dec. 7 . . . Martin T. Manion, executive vice president, Centre Foundry & Machine Co., Wheeling, W. Va., died Dec. 15 . . . Thomas J. Donnelly, 88, one of the two organizers of the Pattern Makers Association of Cleveland, died Dec. 17.

SAND SYMPOSIUM: Northeastern Ohio Chapter, AFS, will present a sand symposium on four successive Thursdays, Jan. 12, Jan. 19, Jan. 26, and Feb. 2. Speakers and their subjects include the following: Jan. 12—Prof. W. G.

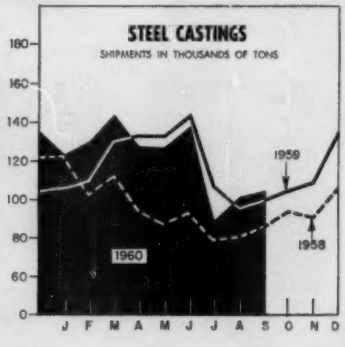
Foundry Statistics



COPPER-BASE CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments			
	Total	Sand	Perm. Mold	Unfilled Orders[2]
1958	762,484	697,360	31,854	.....
1959				
Sept.	73,290	63,813	4,758	29,396
9 mo.	654,312	576,784	38,210	.....
Oct.	77,385	67,186	5,120	28,092
Nov.	68,255	59,094	4,840	29,147
Dec.	71,110	62,182	4,286	29,243
Total	871,032	765,246	52,456	.....
1960				
Jan.	73,971	65,742	3,915	26,053
Feb.	71,797	63,103	4,146	26,970
Mar.	75,906	66,517	4,346	27,470
Apr.	66,777	58,453	4,523	27,423
May	66,299	57,848	4,463	24,582
June	64,585	56,441	3,715	21,781
July	48,399	42,778	2,910	22,367
Aug.	63,765	56,344	3,669	21,915
Sept.	61,357	54,099	3,699	21,063
9 mo.	592,858	521,325	35,486	.....



STEEL CASTINGS—SHIPMENTS

(Net tons[1])

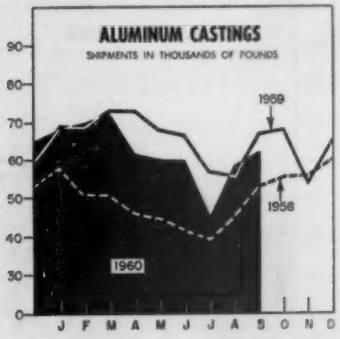
	All Castings			Carbon			Alloy			
	Total	For Sale	Railway Specialties	Total	For Sale	Railway Specialties	Total	For Sale	Railway Specialties	Unfilled Orders[2]
1958	1,121,000	856,986	149,644	801,846	606,240	136,251	319,154	250,746	13,393	.....
1959										
Sept.	99,731	79,963	13,975	73,648	58,453	12,830	26,083	21,510	1,145	256,871
9 mo.	1,064,509	837,654	168,533	786,448	613,507	155,224	278,061	224,147	13,309	.....
Oct.	105,570	84,850	11,819	80,127	63,901	10,978	25,443	20,108	841	268,874
Nov.	109,460	86,026	11,764	77,320	59,294	10,799	32,240	26,732	965	301,858
Dec.	133,346	104,138	18,868	99,643	77,517	17,200	33,703	26,621	1,668	306,346
Total	1,412,885	1,112,668	210,984	1,043,538	814,219	194,201	369,447	297,608	16,783	.....
1960										
Jan.	122,565	94,052	22,016	93,197	70,815	20,891	29,368	23,237	1,125	314,237
Feb.	129,259	97,927	26,532	96,888	72,963	25,328	32,371	24,964	1,204	279,684
Mar.	143,708	109,688	27,801	104,742	78,755	26,365	38,966	30,933	1,436	277,982
Apr.	127,219	96,557	26,101	93,433	70,251	24,526	33,786	26,306	1,575	248,902
May	126,580	97,231	26,793	93,700	71,808	25,324	32,880	25,423	1,469	252,293
June	136,992	107,076	29,185	101,294	78,601	27,503	35,698	28,475	1,682	233,765
July	89,565	67,294	16,196	63,753	47,570	15,570	25,812	19,724	626	223,880
Aug.	101,709	77,146	16,113	73,338	55,099	15,207	28,371	22,047	906	213,611
Sept.	104,298	79,556	16,843	74,447	56,126	15,945	29,851	23,430	898	199,413
9 mo.	1,061,895	826,527	207,580	794,792	601,983	196,659	287,103	224,539	10,921	.....

[1]Source: Bureau of the Census. [2]For sale only.

Lawrence, Alfred University, "Unbonded Molding Sands and Clay Bonds"; Jan. 19—Prof. R. W. Heine, University of Wisconsin, "Mulling and Compacting of Molding Sands"; Jan. 26—Edward C. Zuppann, Bendix Corp., "Oil-Bonded and Shell Cores" and Robert J. Mulligan, Archer-Daniels-Midland Co., "CO_2 and Furan Cores"; Feb. 2, Joseph Schumacher, Hill & Griffith Co., "Sand Testing vs. Molding Methods."

PERSONALS: Harold H. Miller, recently foundry superintendent, Buick Motor Div., Flint, Mich., has been made general superintendent in charge of Buick engine plant and foundry operations. He is succeeded as foundry superintendent by Glen W. Cline Jr. . . . Donald R. Hepler, formerly vice president-manufacturing, Cooper-Alloy Corp., Hillside, N. J., has joined Brillion Iron Works Inc., Brillion, Wis., as Foundry Div. manager . . . David W. Boyd has been promoted to executive vice president, Engineering Castings Inc., Marshall, Mich. He is succeeded as vice president and general manager by J. Raymond Mohlie, recently vice president, Rich Mfg. Corp., Battle Creek, Mich. . . . Howard W. Brandt, formerly vice president, Hydreco and Aurora Divisions, New York Air Brake Co., has been made vice president and group executive, National Malleable & Steel Castings Co., Cleveland . . . Fred J. Pfarr, formerly plant manager, Lake City Malleable Co., Cleveland, has become a sales representative with Hines Flask Co., Cleveland.

MISCELLANY: Racine Foundry & Mfg. Co., Detroit, has formed a new subsidiary, Racine Custom Metalwork Co. . . . Magnaflux Corp., Chicago, has acquired Metal Control Laboratories, Los Angeles, a materials testing laboratory . . . Gibson & Kirk Co., Baltimore, is installing a 175-kw induction melting furnace and will add two more of similar capacity later in the year . . . Werce Engineering Co., 946 13th Ave., Grafton, Wis., has been formed by Heinz C. Wernecke to handle the sale and licensing of diecasting machines and injection systems . . . New Jersey Zinc Co. has developed a new zinc diecasting alloy said to have the same mechanical properties as its other two alloys but with vastly improved casting properties.



PRODUCTION WORKERS

Estimated Number

	Sept. 1960	Aug. 1960	Sept. 1959
Ferrous	186,700	179,500	195,600
Nonferrous	48,900	48,600	54,300

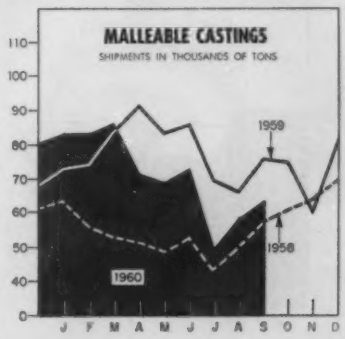
Average Weekly Earnings

Gray Iron	94.24	94.28	95.44
Malleable Iron	92.26	91.94	94.06
Steel	101.52	101.27	98.42
Nonferrous	101.30	101.96	101.76

Average Weekly Hours

Gray Iron	38.0	38.8	39.6
Malleable Iron	37.2	38.0	39.2
Steel	38.6	38.8	38.9
Nonferrous	40.2	40.3	41.2

Source: Bureau of Labor Statistics.



ALUMINUM CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments				Unfilled Orders[2]
	Total	Sand	Perm. Mold	Die	
1958	641,700	125,487	224,092	290,275	.....
1959					
Sept.	66,331	12,254	21,783	32,154	81,839
9 mo.	598,861	105,960	215,837	275,948	.....
Oct.	67,635	12,902	22,058	32,555	78,930
Nov.	54,695	10,757	16,604	27,219	84,392
Dec.	65,208	12,368	20,356	32,379	86,947
Total	786,399	141,987	274,855	368,101	.....
1960					
Jan.	62,247	11,278	22,368	34,514	92,109
Feb.	71,699	11,800	23,614	36,177	83,914
Mar.	72,216	12,934	22,413	36,749	78,024
Apr.	61,797	12,339	19,950	29,490	75,243
May	60,330	10,682	21,507	28,055	75,977
June	60,068	11,280	20,953	27,722	74,699
July	45,694	8,765	15,804	20,973	76,434
Aug.	58,848	10,639	18,901	29,256	75,230
Sept.	62,096	10,514	22,031	29,527	75,144
9 mo.	560,995	100,231	187,541	272,363	.....

[1]Source: Bureau of the Census. [2]For sale only.

MALLEABLE IRON CASTINGS

(Shipments of castings—net tons[1])

	Shipments		Standard		Pearlitic		Unfilled Orders[2]
	Total	For Sale	Total	For Sale	Total	For Sale	
1958	660,650	383,839	540,600	313,597	120,050	70,242	.....
1959							
Sept.	76,063	46,460	60,209	36,619	15,854	9,850	82,274
9 mo.	702,533	420,526	557,779	339,966	144,754	80,540	.....
Oct.	75,511	48,625	61,663	40,088	13,828	8,537	85,031
Nov.	58,256	42,235	48,951	33,981	9,307	8,254	82,555
Dec.	80,060	45,917	61,455	35,891	18,605	10,026	93,874
Total	916,362	557,303	729,868	449,946	186,494	107,357	.....
1960							
Jan.	83,188	46,154	63,637	35,933	19,551	10,221	100,302
Feb.	83,115	46,850	64,131	37,391	18,987	9,459	98,272
Mar.	86,243	49,907	67,448	40,422	18,795	9,485	84,679
Apr.	71,271	39,059	56,136	32,066	15,135	6,993	79,237
May	68,942	37,618	53,108	30,128	15,834	7,492	73,240
June	72,593	43,105	55,956	34,526	16,637	8,579	63,920
July	49,860	28,575	37,187	22,477	12,673	6,098	74,329
Aug.	58,785	36,765	46,522	29,077	12,263	7,688	69,853
Sept.	63,048	36,114	48,635	28,623	14,413	7,491	69,033
9 mo.	637,045	364,147	492,760	290,641	144,488	73,506	.....

Prices of Foundry Metals and Coke

(As of December 26, 1960)

FOUNDRY COKE

(Per net ton, f.o.b. ovens)

BEEHIVE

Connellsville	$18.00-$18.50

OVEN

Birmingham	$30.35
Buffalo	32.00
Detroit	32.00
Erie, Pa.	32.00
Indianapolis	31.25
Kearney, N. J.	31.25
Milwaukee	32.00
Neville Island (Pittsburgh)	30.75
New England, deld.	33.55
New Haven, Conn.	31.00
Painesville, O.	32.00
Philadelphia	31.00
St. Louis	33.00
St. Paul	31.25
Swedeland, Pa.	31.00
Terre Haute, Ind.	31.25

PIG IRON

(Per gross ton, f.o.b. furnace)

	No. 2 Foundry	Malleable
Birdsboro, Pa.	$68.50	$69.00
Birmingham	62.50	66.50
Boston, deld.	77.79	78.29
Buffalo	66.50	67.00
Chester, Pa.	Nom.	Nom.
Chicago	66.50	66.50
Cleveland	66.50	66.50
Duluth	66.50	66.50
Erie, Pa.	66.50	66.50
Fontana, Calif.	75.50	....
Geneva, Utah	66.50	....
Granite City, Ill.	68.40	68.90
Neville Island (Pittsburgh)	66.50	66.50
Swedeland, Pa.	68.50	69.00
Toledo, O.	66.50	66.50
Troy, N. Y.	68.50	69.00
Youngstown, O.	....	66.50

NONFERROUS INGOT

(Cents per pound, carlots)

BRASS AND BRONZE: Red brass, No. 115, 28.25; tin bronze, No. 225, 38.00; No. 245, 32.50; high-leaded tin bronze, No. 305, 32.75; No. 1 yellow, No. 405, 23.50; manganese bronze, No. 421, 27.50.

ALUMINUM: Primary alloy No. 13, 25.90; No. 43, 26.20; No. 195, 27.60; No. 214, 31.50; No. 356, 26.80. Secondary No. 12 alloy, 22.75. Deoxidizing grades: No. 1, 23.75; No. 4, 21.00.

MAGNESIUM ALLOY: AZ91A, 40.75; AZ63A, AZ92A, AZ91C, 40.75, f.o.b. Velasco, Tex.

COPPER: Electrolytic 30.00, delivered Connecticut valley.

ZINC: High grade 13.35, delivered. Die casting alloy No. 3, 15.00; No. 2, 15.50, delivered.

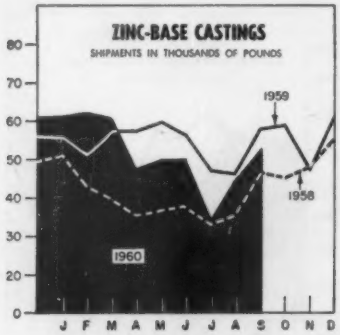
Iron and Steel Scrap

(Consumer prices per gross ton delivered, except as otherwise noted)

	No. 1 Heavy Melting Steel	No. 1 Cupola Cast	Heavy Breakable Cast	Machinery, Cast	Structurals, Plates	Malleable	Short Steel Rails
Birmingham	$28.00-29.00	$41.00-42.00	.....	.....	$35.00-36.00	.....	$44.00-45.00
Boston*	**23.00-24.00	39.00-40.00	.....	**40.00-42.00	.....	.....	.....
Buffalo	23.00-24.00	**36.00-37.00	.....	**43.00-44.00	33.00-34.00	.....	42.00-43.00
Chicago	27.00-28.00	37.00-38.00	.....	42.00-43.00	31.00-32.00	$41.00-42.00	43.00-45.00
Cincinnati*	**22.50-23.50	**34.00-35.00	**28.00-29.00	**44.00-45.00	.....	.....	**44.00-45.00
Cleveland	23.00-24.00	37.00-38.00	26.00-27.00	42.00-43.00	31.00-32.00	42.00-43.00	45.00-46.00
Detroit*	**17.00-18.00	**28.00-29.00	**21.00-22.00	.....	.....	.....	.....
Los Angeles	34.00	35.00	.....	.....	41.00	.....	.....
New York*	27.00-28.00	34.00-35.00	28.00-29.00	.....	31.00-32.00	.....	.....
Philadelphia	34.00	38.00	37.00	47.00-48.00	37.00-38.00	46.00	46.00-48.00
Pittsburgh	26.00-27.00	**31.00-32.00	.....	**43.00-45.00	30.00-32.00	.....	48.00-50.00
St. Louis*	27.00	36.00	31.00	.....	.....	.....	38.00
San Francisco	32.00	46.00-48.00	28.00	45.00-46.00	40.00	.....	.....
Seattle	**36.00	**31.50	**23.00	.....	.....	.....	.....

*Brokers' buying prices. **F.o.b. shipping point

Foundry Statistics



ZINC-BASE CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1958	500,071	319,471	.....
1959			
Sept.	56,035	38,288	60,953
9 mo.	470,997	329,815	.....
Oct.	57,106	40,487	57,814
Nov.	44,611	35,301	58,076
Dec.	58,496	37,406	65,723
Total	631,210	443,009	.....
1960			
Jan.	61,537	39,777	64,940
Feb.	62,925	42,089	66,945
Mar.	60,816	39,618	60,267
Apr.	47,553	31,423	56,312
May	50,844	33,551	56,654
June	50,809	34,264	51,960
July	35,117	25,186	52,392
Aug.	45,101	32,549	57,551
Sept.	52,514	34,451	57,480
9 mo.	467,215	312,908	.....

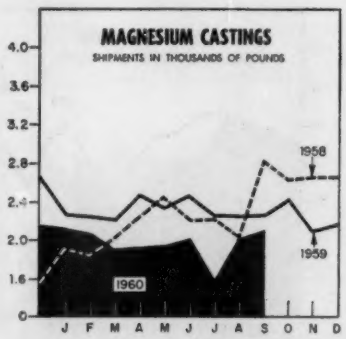
PIG IRON

PRODUCTION**—Net Tons

	Foundry	Malleable & Silvery	Low & Int. Low Phos. & Bessemer
1958	1,622,320	2,448,917	4,954,854
1959			
Sept.	N.A.	N.A.	N.A.
Oct.	N.A.	N.A.	N.A.
Nov.	148,660	180,927	216,063
Dec.	177,017	306,303	452,426
Totals[3]	1,839,445	2,810,359	3,471,683
1960			
Jan.	128,232	325,151	462,667
Feb.	148,238	338,886	471,755
Mar.	126,357	333,182	462,914
Apr.	134,509	258,452	395,875
May	135,825	290,057	356,931
June	105,717	247,991	309,942
July	117,218	166,084	290,384
Aug.	78,950	171,718	211,506
Sept.	93,260	202,895	152,880
Oct.	133,525	183,639	208,758
10 mo.	1,201,831	2,529,757	3,330,193

CONSUMPTION*—Gross Tons

	Cupola	Air	Electric
1958	3,314,652	169,267	231,145
1959			
Aug.	288,547	15,937	4,923
8 mo.	2,690,743	150,837	264,297
Sept.	336,015	18,057	6,033
Oct.	351,679	20,011	5,749
Nov.	276,168	16,350	28,231
Dec.	334,524	18,613	47,045
Total	3,989,129	223,868	351,355
1960			
Jan.	328,242	18,634	45,936
Feb.	322,945	19,257	42,883
Mar.	317,520	21,042	43,959
Apr.	282,178	16,796	36,971
May	292,407	15,730	19,869
June	313,340	16,828	23,720
July	241,752	11,892	21,123
Aug.	272,722	14,697	27,919
8 mo.	2,372,106	134,876	262,380



MAGNESIUM CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1958	28,776	25,024	.....
1959			
Sept.	2,253	1,822	3,823
9 mo.	20,660	17,890	.....
Oct.	2,426	1,880	3,501
Nov.	2,012	1,618	3,281
Dec.	2,154	1,721	3,423
Total	27,253	23,109	.....
1960			
Jan.	2,135	1,588	3,209
Feb.	2,075	1,679	3,278
Mar.	1,903	1,524	3,208
Apr.	1,926	1,533	3,138
May	1,953	1,514	2,948
June	2,050	1,555	3,396
July	1,638	1,234	3,541
Aug.	2,025	1,530	3,364
Sept.	2,146	1,653	3,271
9 mo.	17,851	13,810	.....

*Source: U. S. Dept. of Interior Bureau of Mines: ** Source: American Iron & Steel Institute. [1]Source: Bureau of the Census. [2]For sale only. [3]Monthly figures do not add up to totals shown because of unreported monthly revisions.

Drop by Drop . . . IN 1959
FOUNDRYMEN USED
241 TONS OF
LYQUAGRIP*

READY-TO-USE CORE PASTE

FOR THESE 12 ADVANTAGES

1. Unsurpassed for pasting CO^2 cores
2. Ready mixed, uniform at all times
3. Light colored, odorless, non-corrosive, non-fermenting
4. Dries rapidly at room temperatures
5. Unaffected by normal storage
6. Will not boil or blister
7. No appreciable gas generation
8. Pasted joints are stronger than core
9. Unaffected by mold humidity
10. Extra strong, uses 1/3 to 1/5 as much paste
11. Cores may be reheated without damaging pasted joints
12. Washes off hands and tools easily with warm water

Ask for literature or consult our representative

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COMPANY

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Binder for baking with controlled oven temperatures

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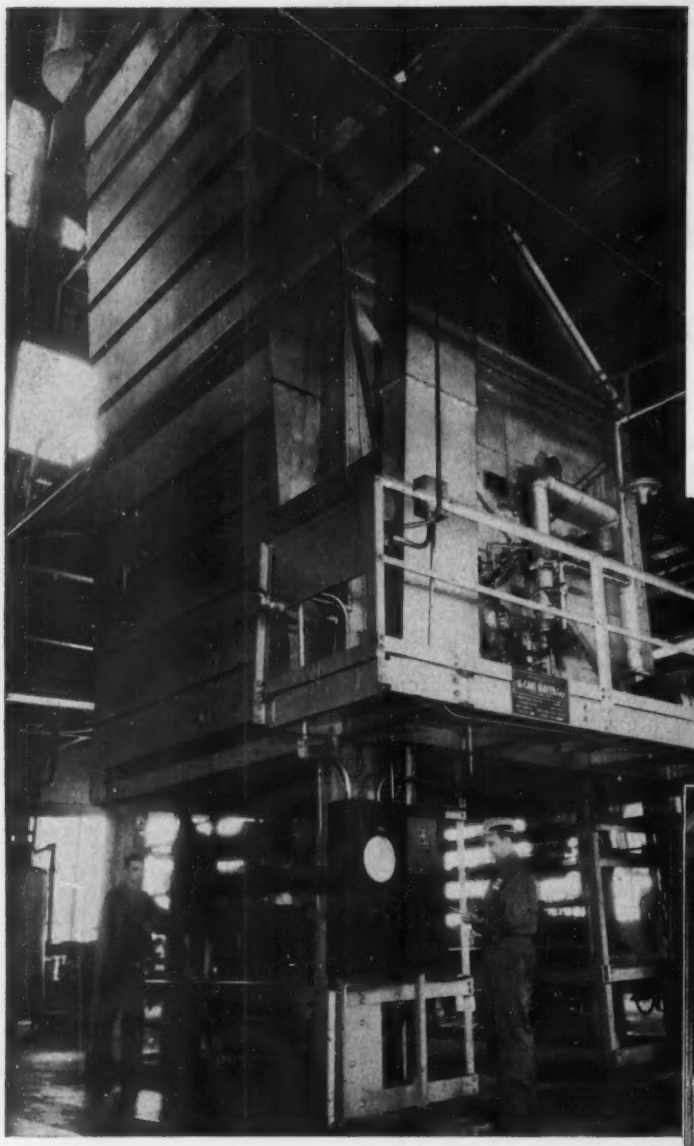
Ovens Designed by carl mayer CORP.

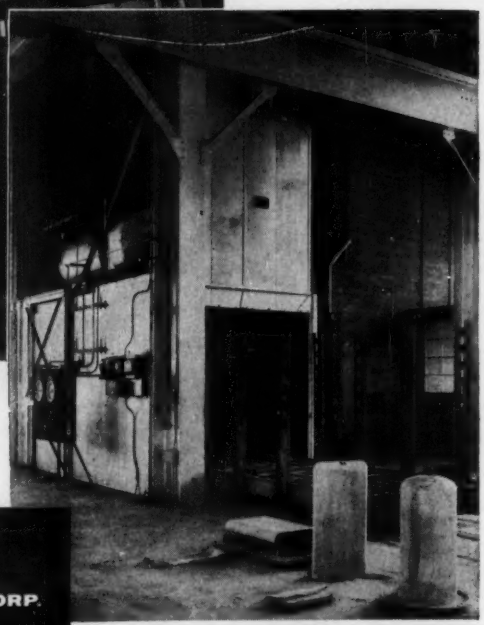


The Carl Mayer Corp. experience in engineering and designing industrial ovens and furnaces is second to none! Carl Mayer ovens incorporate recirculating heating systems with sealed combustion chambers and automatic temperature controls for all fuels. Cores and molds are evenly baked faster, with less fuel consumption.

Many foundries of all sizes have found it pays to install Carl Mayer ovens—Our engineers will be glad to work with you on your oven problems. Write or call now!

Write for Bulletin 53-CM

A NEW VERTICAL CORE OVEN Installed at Forest City Foundry, Cleveland, Ohio. Size is 12' 7" x 11' 10" x 57' 8" high above floor. 29 carriers, 3 shelves high; each shelf 30 x 106 inches. Features forced cooling and exhaust system for uniform cooling of cores before unloading.



CAR TYPE MOLD OVEN at American Brake Shoe Co. features under floor chain car puller. Size 10' x 10' x 19' long.

THE carl mayer CORP.

20800 CENTER RIDGE ROAD CLEVELAND 16, OHIO

OTHER PRODUCTS: Heat Treating Ovens and Furnaces • Rod Bakers • Welding Rod Ovens • Paint and Ceramic Drying Ovens • Special Processing Equipment and Accessories

Aluminum Casting Process Being Licensed in U. S.

The low-pressure aluminum casting process developed by Karl Schmidt G.m.b.H., a subsidiary of Metallgesellschaft A. G., Frankfurt, Germany, and used in this country for the casting of Chevrolet's Corvair engine heads, is being licensed in the U. S. and Canada through Ladd & Little Inc., Huntington Station, N. Y.

The permanent mold casting method has been used in Germany since 1957 and was adopted last year by General Motors for use at the Chevrolet Massena, N. Y., foundry. (See FOUNDRY, August, 1960, Page 57.) Chevrolet has 54 of the furnace and molding units at Massena, purchased from Karl Schmidt and installed by its German engineers.

Other products made by this casting method include Mercedes bonded bimetallic brake drums, Porsche cylinder blocks, Guldner diesel cylinders, the NSU Prinz 2-cycle air-cooled cylinder head, the water-cooled twin cylinder Swedish Nymanbolagen outboard, and the Electrolux twin cylinder outboard.

Ford To Install Dust Control Unit in Cleveland Foundry

Cleveland Foundry, Ford Motor Co., has announced plans to install a new air pollution control system to clean exhaust air from the casting cleaning area. The system will be built by American Wheelabrator Corp., Mishawaka, Ind., and is to be in operation by next fall. It will have a capacity of 650,000 cfm, 50 per cent more than the system which it replaces.

The dust collector consists of a battery of 11,200 bags, each 15 ft high. Suction is generated by 14 large centrifugal exhaust fans, powered by electric motors of 1600-hp total capacity. The bags will be emptied automatically into a sluicing trough, and the mixture of dust and water will be carried to a settling tank with other industrial waste. Dimensions of the unit are 280 by 30 by 15 ft.

New Alloy Used on Nuclear Subs

● TO RESIST the high stresses and corrosion involved in torpedo tube service, the United States Navy has selected the recently developed hardenable cast stainless alloy, CD-4MCu (Alloy Casting Institute designation), for the breech door of the torpedo tube assembly on the new "Thresher" class nuclear attack submarines.

Torpedo tube breech door casting for submarine is 26 in. in diam, weighs 250 lb. (Official U. S. Navy photo)

The SS(N) *Thresher*, first of a group of 14 of this class, has been launched at Portsmouth Naval Shipyard, Portsmouth, N. H., with the new breech door in place.

A precipitation-hardenable cast alloy (25-27 per cent Cr, 4.75-6.00 per cent Ni, 1.75-2.25 per cent Mo, 2.75-3.25 per cent Cu), CD-4MCu was introduced several years ago as a result of an ACI-sponsored research program to find an alloy with the corrosion resistance of the widely used 18-8, but with much higher mechanical strength. First reports indicated the new alloy offered greater mechanical strength than anticipated—about twice that of the standard 18-8 alloys—but later experience also revealed resistance to stress corrosion far superior to that of the wrought 18-8 grades. Engineers at the Portsmouth Naval Shipyard specified CD-4MCu after making their own investigation of the alloy for possible submarine application. During a one-year corrosion testing program, a number of alloys—CD-4MCu, type 304,

ROYAL TOUCH: Recent annual banquet of the Joint Iron Council at Guildhall, London, England, was distinguished by the presence of Prince Philip, the Duke of Edinburgh. He is shown here being greeted by N. P. Newman, right, council president. Prince Philip proposed the toast to the iron industry, and Mr. Newman responded. The Joint Iron Council, the national body representing producers and consumers of foundry pig iron, has the Council of Ironfoundry Associations and the Council of Iron Producers as joint members

BIG production capacity cost savings

WHEELABRATOR® SUPER TUMBLAST®

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Your biggest opportunity to reduce casting cleaning costs still lies in improved production methods.

For example, at the John Deere Malleable Works, East Moline, Ill., management solved the need for increased cleaning capacity with a 28 cu. ft. Wheelabrator Super Tumblast—the most efficient batch type blast cleaning mill ever developed for the foundry industry.

Provides reliable performance. The automated operating features of this new unit permit efficient use of machine and man power.

Higher production. The Super Tumblast cleans faster and more thoroughly. In a typical week more than 300 tons of nodular, perlitic malleable and malleable castings are cleaned. Loads are cleaned in from three to seven minutes each.

Reduced Parts and Maintenance Costs. High efficiency abrasive separation (with the new CFR Separator) and Long-Lyfe wear parts combine to slash maintenance, parts replacement costs, and practically eliminate downtime.

Reduced Abrasive Cost. Abrasive costs per ton of castings cleaned have been greatly reduced.

These results are typical of the experience of over 200 users of the Super Tumblast. For complete details, write today for your copy of the new 32 page Super Tumblast Catalog, Bulletin No. 162-D.

WHEELABRATOR
CORPORATION

505 S. Byrkit St., Mishawaka, Ind.

world's largest manufacturer of airless blast cleaning equipment, quality steel abrasives, and dust control equipment.

Circle 567 on Page 39

nickel - copper, aluminum - bronze, among others—were subjected to running sea water tests to determine resistance to galvanic, crevice, and stress corrosion. Results showed that the new CD-4MCu alloy had superior corrosion resistance in all of the tests. In six-months' stress corrosion tests, no failures of either hardened or annealed CD-4MCu alloy specimens occurred.

Mechanical Properties — Typical mechanical properties of the castings: 110,000 psi tensile strength; 85,000 psi yield strength; 25 per cent elongation; Charpy impact (V-notch) 40-50 ft-lb. The casting shown in the accompanying illustration is 26 in. in diam and weighs 250 lb.

In stress corrosion tests by laboratories of the Sharples Corp., Philadelphia, cast type CD-4MCu was compared with type 304 and molybdenum-containing type 316 wrought alloys. All specimens were exposed to boiling 42 per cent $MgCl_2$ for 100 hours. CD-4MCu in the hardened condition (solution annealed, 2 hours at 2050° F, oil quenched, aged 4 hours at 975° F) sustained a stress of 62,000 psi without cracking whereas annealed type 316 cracked at 8000 psi, and annealed type 304 cracked at 12,000 psi.

Ductile Iron Group Holds Meetings

● THREE regional meetings were held recently by the Ductile Iron Society, national trade association of producers of ductile iron castings.

A meeting at Columbus, Ohio, on Nov. 18 was attended by 26 representatives of 13 foundries. Speaking at this meeting, William Beatty, Morris Bean & Co., Yellow Springs, Ohio, and vice president of the society, pointed out that each foundry is a group of specialists and no two foundries are alike. In the case of his company, its specialty is the production of ductile iron precision tire molds, as well as a major producer of plaster molded nonferrous castings.

A director of the society, Sam F. Carter, American Cast Iron Pipe Co., Birmingham, emphasized the necessity for close control in the production of ductile iron.

Speaking of possible economies in castings production, R. J. Gairing, Wadsworth Foundry Co., stressed that economies are worthless if they detract from the production of a good sound casting.

Society President Robert S. Thompson, H. P. Deuscher Co., Hamilton, Ohio, cautioned that the average sale is made after five calls; consequently every first-call sale should be expected to be followed by another requiring ten calls. Make each of your employees a salesman to fill the customer's requirements, he recommended.

Other meetings of the Ductile Iron Society were held in New York Dec. 9 and at Chicago Dec. 16.

Representatives of member firms at Nov. 18 meeting of Ductile Iron Society

Steel Founders Make Safety Awards at T & O Conference

THIRTY-SIX technical papers in five general areas of foundry practice were presented during the recent three-day Technical and Operating Conference of the Steel Founders' Society of America.

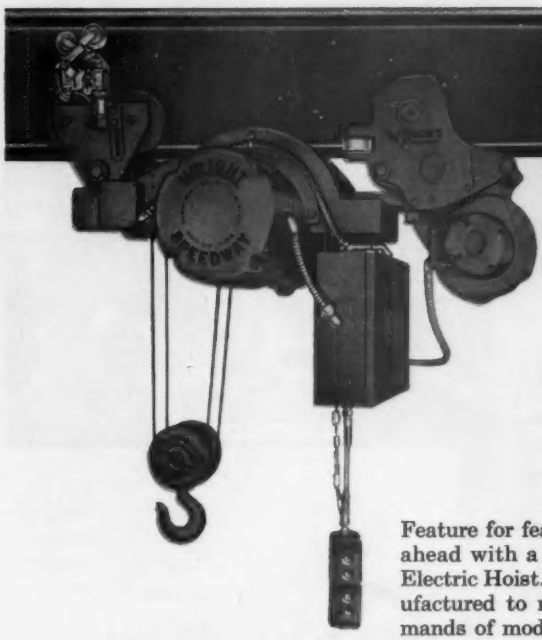
W. H. Moriarty, president of the SFSA and first vice president and group executive of the National Malleable & Steel Castings Co., Cleveland, welcomed nearly 500 technical and operating men from every section of the U. S. and Canada to the sessions. The conference was under the direction of Dale L. Hall, Oklahoma Steel Castings Co., chairman of the T and O Committee of the society. Papers presented covered a wide array of steel foundry subjects.

DALE L. HALL

Steel foundries participating in the 14th annual safety contest sponsored by the Steel Founders' Society of America recorded the second lowest frequency rate in the history of the contest, according to James Holtzapple, chairman of the SFSA Safety Committee.

Thirty-nine Highest Honor Safety Awards and 24 Certificates of Safety Achievement were presented to winning steel foundries at the 15th annual Technical and Operating Conference held in Cleveland Nov. 14-16. The 129 foundries entered in the 1960 contest reported an accident frequency rate of 14.1, a rate bettered only in 1958 when it was 12.9. The contest was held during June, July, and August.

The participating foundries were



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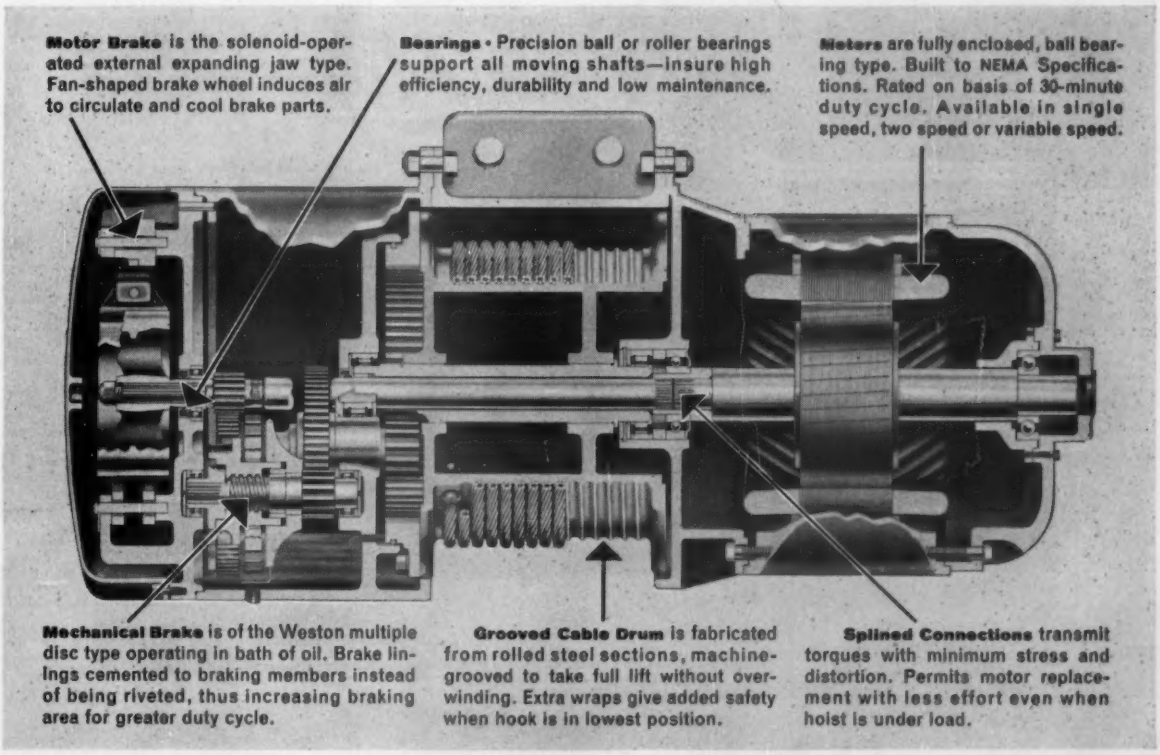
Feature for feature, you are years ahead with a WRIGHT *Speedway* Electric Hoist. Designed and manufactured to meet the varied demands of modern high speed production, *Speedway* Hoists give you the safety, adaptability, ruggedness and efficiency which you can't get in a low-priced hoist. Many of these performance and maintenance features are exclusive with WRIGHT. So if you are considering the purchase of an electric hoist, it will pay you to investigate the advantages of WRIGHT *Speedway* Hoists. For complete information, write our York, Pa., headquarters for **Catalog E-58.**


Motor Brake is the solenoid-operated external expanding jaw type. Fan-shaped brake wheel induces air to circulate and cool brake parts.
Bearings • Precision ball or roller bearings support all moving shafts—insure high efficiency, durability and low maintenance.
Motors are fully enclosed, ball bearing type. Built to NEMA Specifications. Rated on basis of 30-minute duty cycle. Available in single speed, two speed or variable speed.
Mechanical Brake is of the Weston multiple disc type operating in bath of oil. Brake linings cemented to braking members instead of being riveted, thus increasing braking area for greater duty cycle.
Grooved Cable Drum is fabricated from rolled steel sections, machine-grooved to take full lift without overwinding. Extra wraps give added safety when hook is in lowest position.
Splined Connections transmit torques with minimum stress and distortion. Permits motor replacement with less effort even when hoist is under load.

See your WRIGHT Distributor *about the Speedway Electric Hoist line in the ¼ to 10-ton capacity range*

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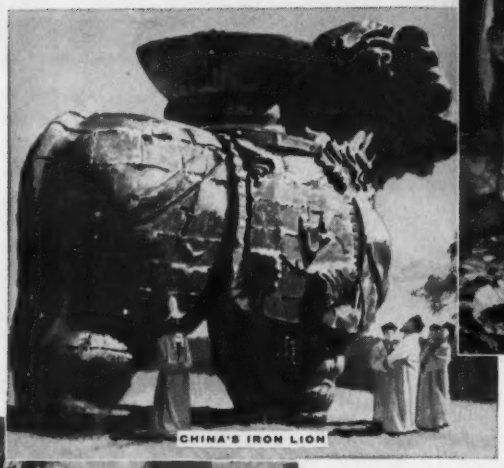
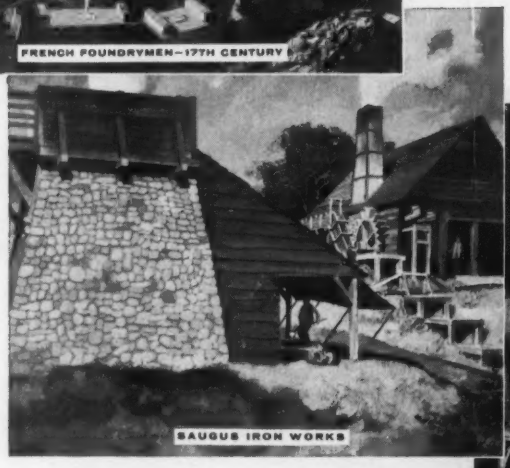
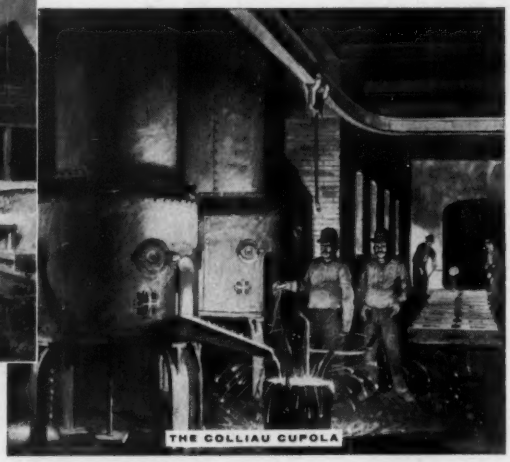


Gray Iron Foundry Milestones





In tribute to the great Foundry Industry, Pittsburgh Coke & Chemical Company has taken pleasure in presenting its version of Gray Iron Foundry Milestones. It is equally proud to serve the nation's foundry trade as a basic supplier.

Enlarged reproductions (11½ x 11″, suitable for framing) of the illustrations above are available. Any one or a complete set of the etchings will be sent to you without cost, upon request.

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divided into four approximately equal groups on the basis of manhours of exposure per month. Highest Honor Safety Awards were earned by foundries with the best record in each group. In groups 1, 2, and 3, several foundries tied for first place with frequency rates of zero. In group 1, there were 21 winners; in group 2, nine winners; in group 3, eight winners. In group 4, only one foundry had a zero frequency.

Certificates of Safety Achievement were awarded 24 foundries whose cumulative frequency rate for the contest period was less than 10.

The list of winners follows:

HIGHEST HONOR AWARDS

Group No. 1—1 to 25 Thousand Manhours

Alloy Steel & Metals Co., Los Angeles, Calif.; Arneson Foundry Inc., Kenosha, Wis.; Caldwell Foundry & Machine Co., Birmingham; Calumet Steel Corp., Hammond, Ind.; Dayton Steel Foundry Co., Dayton, Ohio; Eastern Malleable Iron Co., Wilmington, Del.; East Texas Steel Castings Co., Longview, Tex.; Electrocast Steel Foundry Co., Cicero, Ill.; ESCO Ltd., Foundry Div., Port Coquitlam, B. C., Canada.

Florida Machine & Foundry Co., Jacksonville, Fla.; Hughes Tool Co., Houston, Tex.; Monroe Steel Castings Co., Joplin, Mo.; National Supply Co., Torrance, Calif.; Pacific Car & Foundry Co., Renton, Wash.; Standard Steel Works Div., Burnham, Pa.; Texas Foundries Inc., Lufkin, Tex.; Tonawanda Electric Steel Casting Corp., North Tonawanda, N. Y.; Treadwell Engineering Co., Easton, Pa.; Unitcast Corp., Foundry No. 1, Toledo, Ohio; Worthington Corp., Harrison, N. J.

Group No. 2—26 to 50 Thousand Manhours

American Cast Iron Pipe Co., Birmingham; Atlantic Foundry Co., Akron, Ohio; Burnside Steel Foundry Co., Chicago; National Roll & Foundry Div., Avonmore, Pa.; Massillon Steel Casting Co., Massillon, Ohio; Pacific Southern Foundries Inc., Bakersfield, Calif.; Pelton Steel Casting Co., Milwaukee; Sawbrook Steel Castings Co., Cincinnati; Steel Casting Co., division of Shaffer Tool Works, Los Angeles.

Group No. 3—51 to 85 Thousand Manhours

American Steel Foundries, Indiana Harbor Works, East Chicago, Ind.; Blaw-Knox Co., Coraopolis Works, Coraopolis, Pa.; Dominion Foundries & Steel Ltd., Hamilton, Ont., Canada; Fahralloy Canada Ltd., Orillia, Ont., Canada; Fort Pitt Steel Casting Div., McKeesport, Pa.; Mackintosh-Hemphill Div., Midland, Pa.; Oklahoma Steel Castings Co., Tulsa, Okla.; Texas Electric Steel Casting Co., Houston, Tex.

Group No. 4—86 and Up Thousand Manhours

Birdsboro Corp., Birdsboro, Pa.

CERTIFICATE AWARDS

(Frequency rates as indicated)

General Steel Castings Corp., Granite City, Ill., 1.3; Blaw-Knox Co., East Chicago Works, East Chicago, Ind., 1.4; American Steel Foundries, Granite City Works, Granite City, Ill., 2.9; Blaw-Knox Co., Union Steel Castings Works, Pittsburgh, Pa., 3.1; Pittsburgh Steel Foundry Co., Glassport, Pa., 3.2; LFM Mfg. Co. Inc., Atchison, Kans., 4.4; National Malleable & Steel Castings Co., Cicero, Ill., 5.1; Dodge Steel Co., Philadelphia, Pa., 5.5; Sivyer Steel Casting Co., Milwaukee, 5.6; Crucible Steel Co. of America, Harrison, N. J., 6.7.

National Malleable & Steel Castings Co., Melrose Park, Ill., 6.9; American Steel Foundries, Alliance Works, Alliance, Ohio, 7.0; National Malleable & Steel Castings Co., Sharon, Pa., 7.5; Ohio Steel Foundry Co., Springfield, Ohio, 7.8; Cooper Alloy Corp., Hillside, N. J., 7.9; Ohio Steel Foundry Co., Lima, Ohio, 8.0; General Steel Castings Corp., Eddystone, Pa., 8.1; Texas Steel Co., Fort Worth, Tex., 8.1; Canadian Steel Foundries Ltd., Montreal, Que., Canada, 8.2; Ross-Meehan Foundries, Chattanooga, Tenn., 8.2; ESCO Corp., Portland, Oreg., 8.8; ACCO Steel Casting Div., Reading, Pa., 9.0; Penn Steel Castings Co., Chester, Pa., 9.8; Lebanon Steel Foundry, Lebanon, Pa., 9.9.

FEF Extends Scholarship Program

● A Foundry Educational Foundation scholarship program has been established at three leading technical institutes: Wentworth Institute in Boston, Erie County Technical Institute near Buffalo, and Western Michigan University in Kalamazoo, Mich.

Scholarship funds for this program were provided to the FEF by American Brake Shoe Co., Dow Chemical Co., and Griffin Wheel Co. In each case the money represents a contribution over and above each company's membership contribution to the FEF.

Purpose—The technical institute scholarship program is intended to:

1. Assist outstanding young men in obtaining an education at the technician level in the field of cast metals.

2. Recognize the fine work being done in the cast metals field at these three schools and to show the industry's appreciation to the teaching staffs on each campus.

3. Create another source of technical talent so critically needed in the foundry industry.

4. Foster a greater awareness of the foundry industry and its products on the part of all student technicians enrolled at these schools.

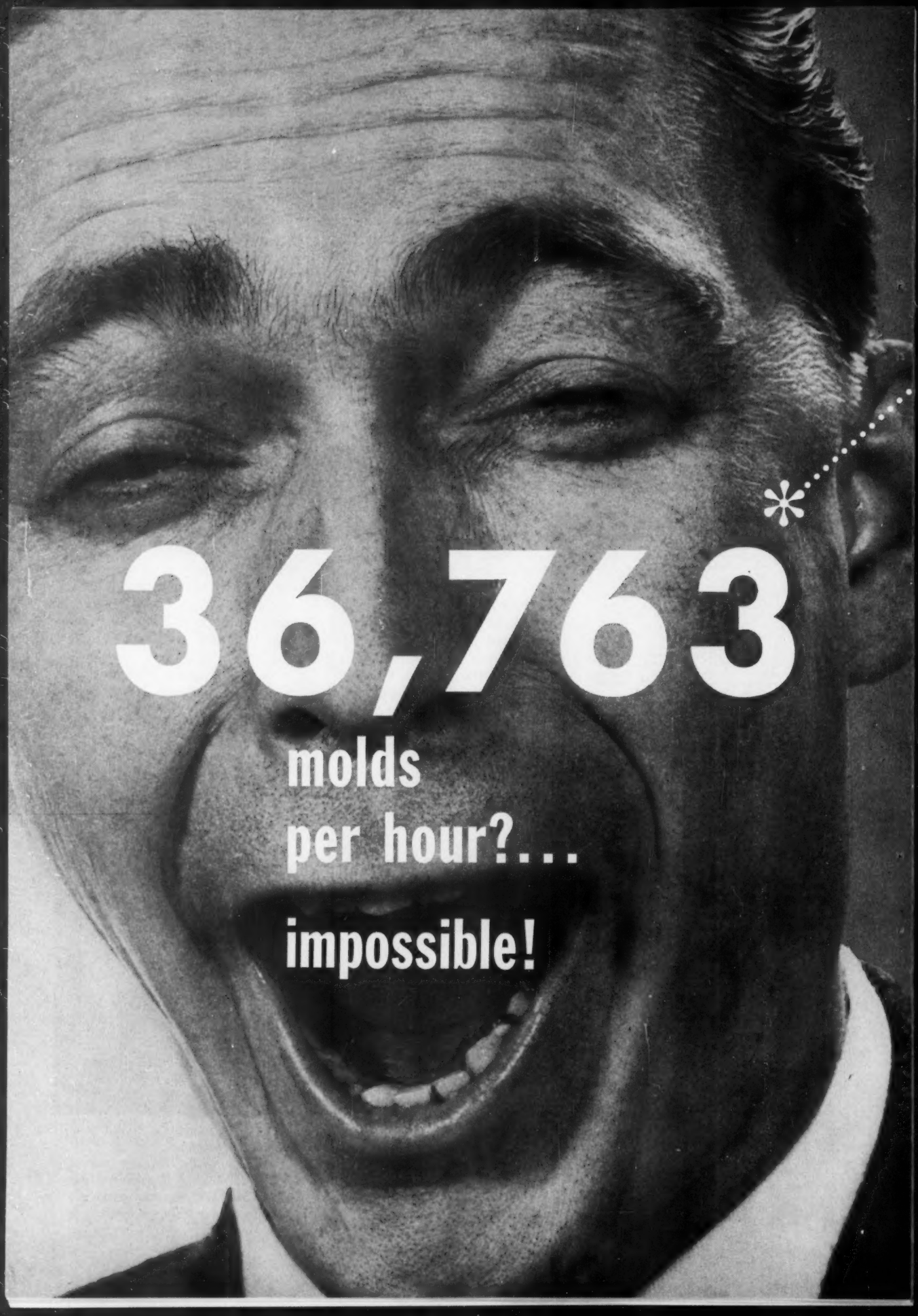
Wentworth Institute, incorporated in 1904, offers several two-year programs to prepare young men for careers as engineering technicians.

Erie County Technical Institute is a part of the State University of New York. On Sept. 1, 1960, the institute occupied a complete new facility of eight buildings on a 120-acre campus situated in Amherst, N. Y. (adjacent to the Buffalo Airport).

Western Michigan University in Kalamazoo was founded in 1903 as Western State Normal School. Its primary function at the time was the preparation of teachers for the state of Michigan. Through the years Western Michigan expanded and in 1956 the institution was designated as a state university.

Two additional scholarships were established recently at Western Michigan by the AFS Central Michigan Chapter for students

Dr. D. H. Morgan (second from left, seated), Dow Chemical Co., and FEF vice president, presents scholarship check to Wentworth Institute officials. Left to right, seated: C. Wesley Nelson, dean of instruction; Dr. Morgan; Norman Clive, assistant secretary-treasurer. Standing: E. J. Walsh, FEF executive director; Henry G. Stenberg, Draper Corp.; Carl A. Swanson, assistant dean of instruction; J. Gerin Sylvia, senior instructor of the foundry department

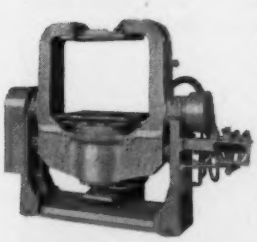

36,763*
molds
per hour?...
impossible!

* THE FIGURE IS RIGHT...

AND ACTUALLY QUITE CONSERVATIVE!

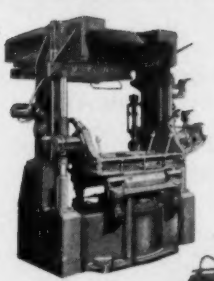
The identification trade mark of SPO states that this organization is the "World's largest supplier of mold-machines." This is not just another advertising claim. There are SPO machines operating all over our globe . . . in almost every country. At this moment, men of every race, creed and color . . . and speaking virtually every language and dialect in the world . . . are producing molds on machines bearing the name SPO. It is our conservative estimate that MORE than 36,763 molds will be produced in THIS hour.

Our leadership has been earned . . . earned through long years of devotion to the industry and applied skill within individual professions comprising the entire field of metals. In foundry molding systems, our technological advances resulting from creative engineering, have established new horizons of molding progress.

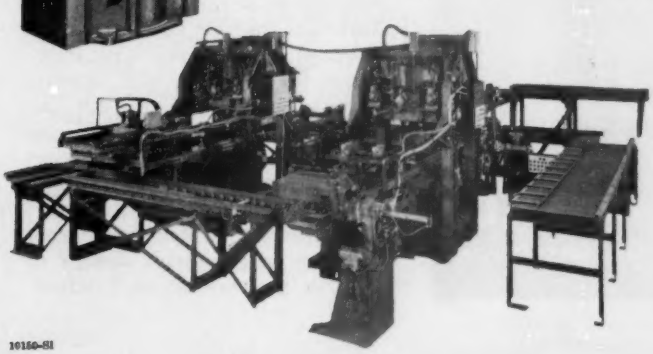


SPO leadership will not go unchallenged . . . however . . . we propose to continue our dedication to progress. We will continue to improve our creative engineering services so that we can continue to supply versatile, efficient, economical "packaged" systems to meet every molding requirement, including Turnkey facilities.

THERE'S A SPO MACHINE FOR EVERY MOLDING JOB



In an industry as specialized as the foundry, leadership cannot be assumed . . . it must be earned through capability and accomplishment.



WORLD'S LARGEST SUPPLIERS SPO OF MOLDING MACHINES

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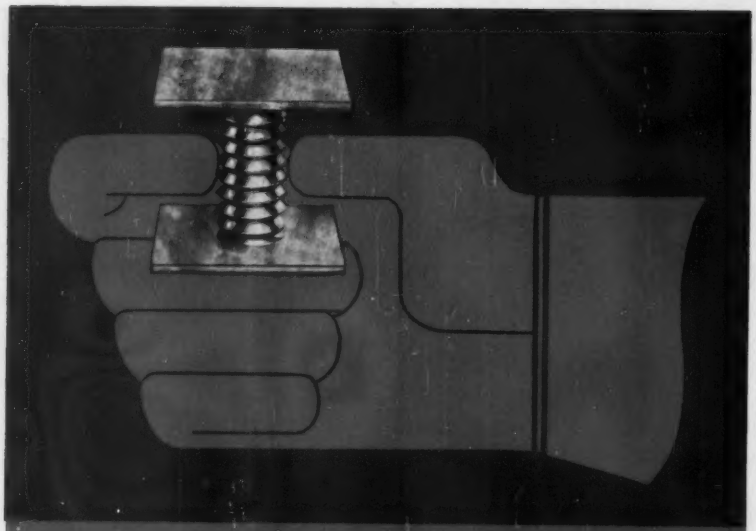

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MILWAUKEE
CHAPLET
or CHILL
for every
CASTING JOB
to insure better castings
to reduce scrap losses
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from its area. All three scholarships are administered by FEF. Scholarships also are available through the D. J. Campbell Fund in Muskegon, Mich.

Key Professors Named—Following a custom established at the engineering degree - granting FEF schools, a key professor has been appointed to act as the official contact with foundry industry representatives and to direct the scholarship program. J. Gerin Sylvia is in charge of the FEF program at Wentworth. Harry G. Kassidy, head, Department of Metallurgical Technology at Erie County Technical Institute, is directing FEF activities there. At Western Michigan University, Dr. J. W. Giachino, head of the Engineering and Technology Department, is the FEF key contact.

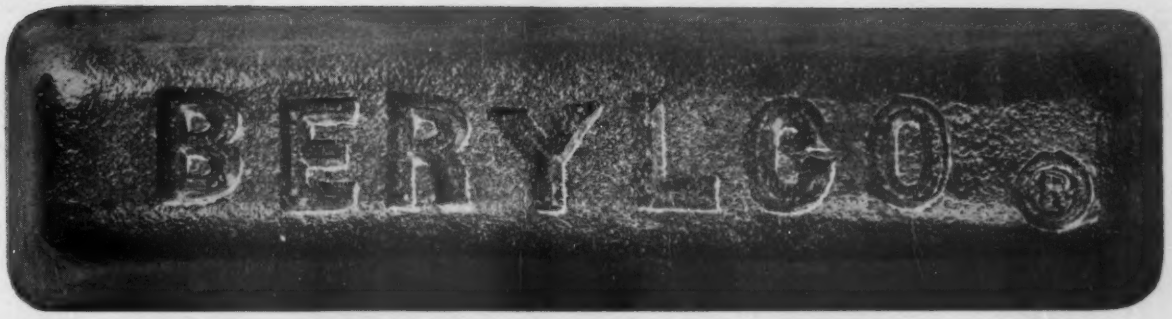
Sketch of the new Erie County Technical Institute outside Buffalo

Russell Strong Hall at Western Michigan University, Kalamazoo, Mich.

The program of study at Western Michigan includes 65 hours of course work, much of which pertains directly to cast metals. Wentworth Institute permits students in the Metals Engineering technology program to follow an option in foundry operations during the second year of study. Erie County Technical Institute operates on the co-operative plan, combining training in the classroom with employment in industry. Erie Tech students receive approximately six months of employment training out of their total schooling of 24 months.

Applications for FEF scholarship assistance will be made directly to the key professor at each school.

Circle 571 on Page 39



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Hard as Steel, With Fine Fluidity, Detail, Castability and Ease of Handling

BERYLCO casting alloys offer you a combination of properties, not just outstanding, but actually unique. The strength of steel, the electrical conductivity of copper, high resistance to corrosion and wear . . . all these and other characteristics become part of the casting . . . without creating problems for the foundryman.

In sand, investment or pressure casting, the fluidity of molten BERYLCO beryllium copper alloys is excellent. Intricate detail can be obtained in parts "as cast". Low pouring temperature and castability provide distinct foundry advantages over ferrous and non-ferrous materials with comparable physical and mechanical properties.

At BERYLCO, we maintain a complete organization of specialists available to you for technical information and assistance in any phase of beryllium copper casting. These service aides are experienced men who know foundries and come prepared to solve problems. BERYLCO beryllium copper casting alloys have been developed to solve problems. Write today for detailed information on the advantages applicable in your own foundry.

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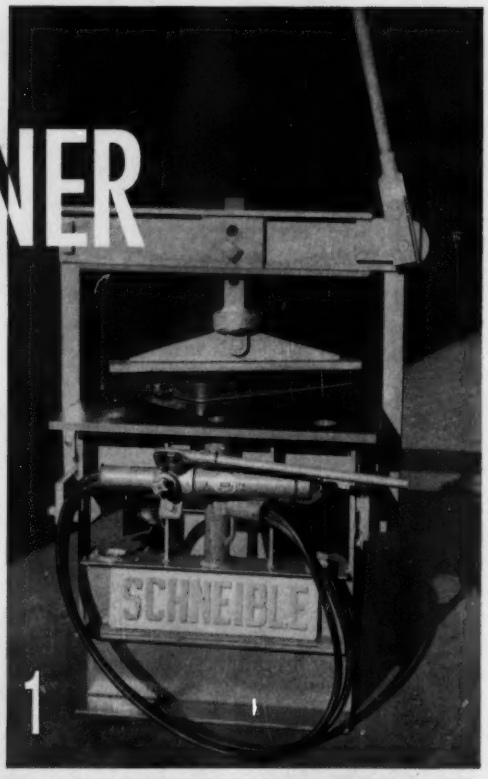
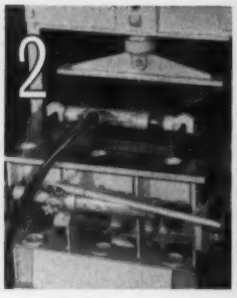
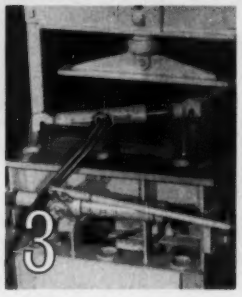
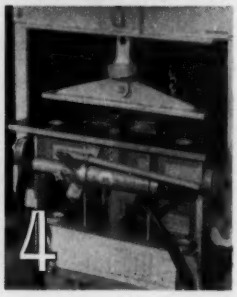
WORKS 4 WAYS to make foundry flasks accurate—serviceable and profitable, longer!









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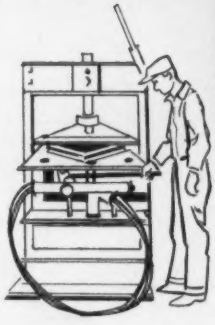
2 **RESETS PIN CENTERS** . . . Hydraulic tool adjusts pin centers to get perfect alignment of cope and drag for accurate molding.

3 **RESHAPES FLASKS** . . . Bent sides, ends or "out-of-square" flasks can be easily reshaped with hydraulic tool. Prevents casting errors and time-wasting machining operations.

4 **REPLACES WORN PINS AND BUSHINGS** . . . Hydraulic ram easily positioned for replacement of pins and bushings.



Your flask handlers can reclaim damaged flasks during slack periods, saving replacement costs and making more of them available for service when schedule demands.

FLASKONDITIONER is the newest aid to greater foundry profits. A new way to put dead dollars to work. FLASKONDITIONER reclaims bent-up, "out-of-square", inactive flasks.

This sturdy unit is constructed of heavy hot rolled steel throughout. The structural base supports a machined surface plate for checking and correcting sand joints.

Flask clamp height is adjustable for any flask depth.

Clamp carriage is on ball bearing rollers, moving easily forward and backward to accommodate full flask width.

A precision-built hydraulic unit, manually operated, activates a ram which can be located in three or more positions, depending on the model.

Accommodations for flask sizes up to 20″x30″... 26″x42″ ... 34″x54″... and up to 44″x66″are standard units. Larger sizes are made on special order.

Get *all* your flasks in top working condition with FLASKONDITIONER. Stop troublesome casting problems now. Write, phone or mail coupon for complete details and prices, today.

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Write for Bulletin 161

SCHNEIBLE

CALENDAR of Meetings

Jan. 9-13—Society of Automotive Engineers, International Congress & Exposition, Convention Center, Detroit.

Jan. 10—Hoist Manufacturers Association, annual meeting, Statler Hilton Hotel, Cleveland.

Jan. 23-26—Plant Maintenance & Engineering Show, International Amphitheatre, Chicago.

Feb. 9-10—Wisconsin Regional Foundry Conference, Schroeder Hotel, Milwaukee.

Feb. 16-17—Southeastern Regional Foundry Conference, Read House, Chattanooga, Tenn.

Feb. 22-24—Alloy Casting Institute, Midwinter Management Meeting, Boca Raton, Fla.

Feb. 22-24—Material Handling Institute, Pacific Coast Show, Cow Palace, San Francisco.

Feb. 26-Mar. 2—American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, St. Louis.

March 1-2—Malleable Founders' Society, Technical & Operating Conference, Pick-Carter Hotel, Cleveland.

March 11-14—Steel Founders' Society of America, annual meeting, Drake Hotel, Chicago.

March 13-17—National Association of Corrosion Engineers, Corrosion Show and Annual Conference, Buffalo.

March 20-24—American Society for Metals, Western Metal Congress & Exposition, Pan-Pacific Auditorium, Los Angeles.

April 10-12—American Institute of Mining, Metallurgical & Petroleum Engineers, Open Hearth Steel Conference, Sheraton Hotel, Philadelphia.

April 18-20—American Welding Society, Annual Meeting & Welding Show, Commodore Hotel and Coliseum, New York.

April 18-20—Foundry Educational Foundation, annual college-industry conference, Hotel Statler-Hilton, Cleveland.

May 8-12—American Foundrymen's Society, Castings Congress & Exposition, San Francisco.

May 9-11—Material Handling Institute, Eastern States Show, Trade and Convention Center, Philadelphia.

May 22-25—American Society of Mechanical Engineers, Design Engineering Show, Cobo Hall, Detroit.

June 8-9—Malleable Founders' Society, annual meeting, Broadmoor, Colorado Springs, Colo.

June 13-14—Connecticut Safety Society, annual meeting, Statler-Hilton Hotel, Hartford, Conn.

June 18-20—Alloy Casting Institute, annual meeting, Homestead, Hot Springs, Va.

June 22-24—Penn State Regional Foundry Conference, Pennsylvania State University, University Park, Pa.

June 25-30—American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

Sept. 18-20—Non-Ferrous Founders' Society, annual meeting, Shawnee Inn, Shawnee-on-Delaware, Pa.

Sept. 21—Cast Bronze Bearing Institute, annual meeting, Shawnee Inn, Shawnee-on-Delaware, Pa.

Sept. 24-26—Steel Founders' Society of America, fall meeting, Homestead, Hot Springs, Va.

Oct. 7-10—Conveyor Equipment Manufacturers Association, annual meeting, Ponte Vedra Inn, Ponte Vedra Beach, Fla.

Oct. 18-20—Gray Iron Founders' Society, annual meeting, Royal York Hotel, Toronto, Ont.

Oct. 19-21—Foundry Equipment Manufacturers Association, annual meeting, Greenbrier, White Sulphur Springs, W. Va.

Oct. 23-27—American Society for Metals, National Metal Congress & Exposition, Cobo Hall, Detroit.

Nov. 13-15—Steel Founders' Society of America, Technical & Operating Conference, Hotel Pick-Carter, Cleveland.

Nov. 15-17—National Foundry Association, annual meeting, Savoy-Hilton Hotel, New York.

Standardize with

MASTER POWER AIR TOOLS

Compared to other capital goods equipment, portable air tools are a minor production-line expenditure . . . yet, if they loaf on your job they can cost you considerably in lost profits. The outstanding performance of Master Power Air Tools makes the difference. Master Power's premium power in lighter weight tools means less operator fatigue, higher operator efficiency. More power-per-ratio-of-air and more powerful stroke for the same size tool means increased tool efficiency. Important, too, is hard-chromed finish wherever two hard parts work against each other. Result: up to three times normal wear. Saves you considerably on repair bills . . . saves us on extra service calls. And most Master Power Tools have interchangeable parts for extra savings in inventory, less down-time in the plant.

Consult our *Technical Service Dept.* for expert evaluation and design of your plant air tool requirements. No obligation. Simply use coupon below or call us.

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Gentlemen: Please send information immediately on the items checked below:

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☐ Air Hoists ☐ Complete Air Tool Study

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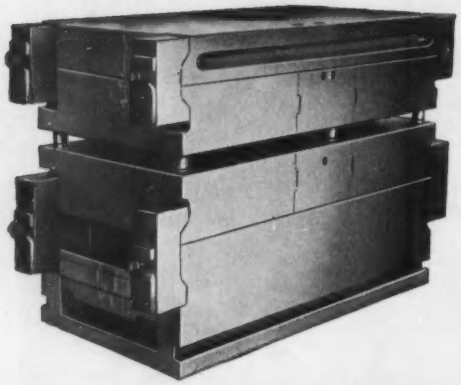
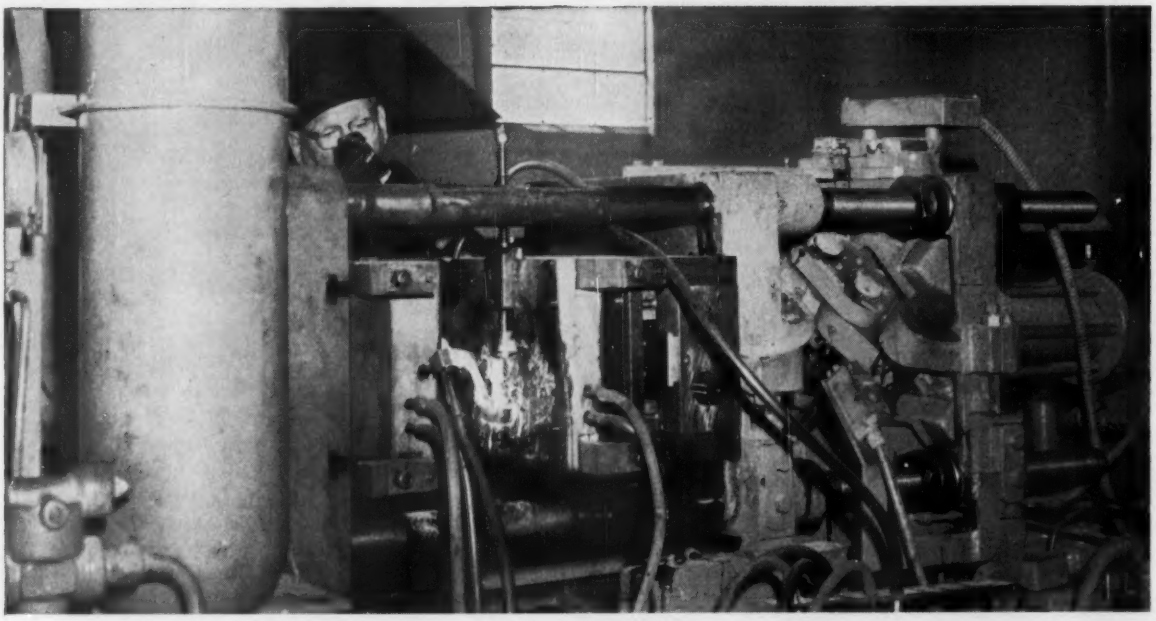


SAVE ON SHORT RUN DIE CASTINGS!

CHANGE DIES IN MINUTES!

With D-M-E Standard Unit Dies for Zinc or Aluminum Die Casting



Cut Die Costs and Save Time with Stock Replacement Units

DIE CHANGES that normally take 3 to 5 hours are done in minutes with D-M-E's Standard Unit Dies for zinc or aluminum die casting.

Standard interchangeable Replacement Units are *in stock* now to reduce your die costs and shorten delivery schedules.

D-M-E's Standard Unit Die assembly offers these unique features for added savings in production time and maintenance:

Construction permits complete freedom on *three sides* of the cavity for placement of cores or cooling lines; six sturdy leader pins and bushings provide accurate alignment and trouble-free performance; and "quick change" wedge clamps for positive positioning of each plate.

Standard Replacement Units are quickly positioned in the Unit Die Holder by a precision T-slot in the mating edge of the plates; there is no interference with the cavity layout.

Whether you require rack and pinion or automatic "bumper-type" ejection, D-M-E has a Standard Unit Die to fit the machine.

D-M-E Unit Die Holders are available for Standard 10″ x 12″ or 12″ x 15″ Replacement Units.

Start saving *now* on your short-run die-casting jobs with D-M-E Standard Unit Dies.

SEVEN BRANCHES FOR FASTER SERVICE

Write **TODAY** for Complete Specifications

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- D-M-E CORP., CLEVELAND: 502 Brookpark Rd.—DAYTON: 558 Leo St.
- D-M-E of CANADA, Inc., TORONTO, ONT.: 156 Norseman Ave.

Circle 575 on Page 39

FOUNDRY

Reader Information Service

Advertising content is classified by subject and listed by page number for your convenience when studying specific foundry applications. For further information on subjects advertised, refer to advertisement on the page indicated and circle Item Number on Reader Service Card —Page 39.

SUBJECT INDEX

Abrasives (shot and grit) 52-53, 154, 170, 194
Aluminum (alloy and ingot) 1, 43, 129

Belting (all types) 9, 14-15, 94
Beryllium 23
Binders 6-7, 128, 156-157, 180-181, 199
Blast cleaning equipment 24-25, 52-53, 205
Buckets 198
Burners 184

Casting machines 8, 204
Chain and Rope 144
Chaplets, Chills, Nails 32, 115
Charging machines (furnaces) 216
Chromium alloys IFC
Clay 189
Coatings (core and mold) 13
Coke 28, 169, 203
Controls, 140, 200
Conveyors 14-15, 116, 135, 185
Corebox cleaners 201
Coremaking machines 125, 151, 193
Cores (strainer) 201
Crucibles and Pots 168, 214
Cupolas 216
Cutoff equipment 152, 183

Dies (diecasting) 36
Dust collecting equipment 100, 132

Electrodes and Holders 113
Electrodes (furnace) 107
Engineering services 163, 200, 202
Epoxy resins 197

Fans 105, 136
Ferroalloys IFC, 123, 192
Finishing (castings) 204
Flasks and related equipment 34, 47, 122, 146, 202
Flour 145
Fluxes 158, 175
Furnaces (all types) 55, 97, 110-111, 143, 161, 165, 177, 184, 199

Gaggers 129
Gases 93
Gas heaters 159
Grinding equipment 2, 203

Hammers (chipping) 150
Hoists 27, 35
Hot blast equipment 216

Idlers (conveyor) 14-15
Impregnating systems 203
Ingot molds 168
Iron powder and briquets 173

Ladles 141, 216
Lubricators (compressed air) 54

Magnets 186
Mold handling 10, 41, 56
Molding machines 30-31, 102-103, 119, 178-179, 205

Nodularizing compounds 129

Ovens (all types) 22, 44, 162, 197

Parting compounds 133
Paste (core) 21
Patterns and equipment 202, 204
Pebbles 204
Pig iron 5, 28, 50-51, 167
Portable tools (electric and pneumatic) 35
Pouring devices 120, 216

Rammers, Butts, Peins 214
Refractories and equipment 11, 48-49, 130-131, 164

Safety equipment 137
Sand 145
Sand preparation equipment 42, 139, 148-149, 155, 191, 200, 201, 203, 205, BC
Sand reclamation equipment BC
Sand slingers 139
Screens 155, 201
Spraying equipment 198

Testing equipment 46, 158, 192, 198, 201, 202
Thermocouples and Tubes 200
Trucks and Front End Loaders 12

Valves (air and hydraulic) 16
Vibrators 155

Warehouse (supplies) IBC

X-ray equipment 45, 99, 195

FOUNDRY

Reader Information Service

Just mail one of these cards—for more information on anything advertised in this issue . . . for further data on products described in the Equipment and Supplies section (Page 95) . . . to get copies of publications listed in the Literature for Foundrymen section (Page 142) . . . to request extra copies of editorial articles.

Index of Equipment and Supplies & Literature for Foundrymen, by Item Numbers

Equipment and Supplies Section (Page 95)

PRODUCT	ITEM NUMBER
Trimming Press	451
Shell Mold Release	452
Heat Treating Furnace	453
Carbon Sand	454
Temperature Recorder	455
Air Vibrators	456
Platform Truck	457
Interchangeable Cylinder	458
Vertical Conveyor	459
Grain Refiner	460
Electric Hoists	461
Wheel Dresser	462
Welding Tools	463
Roof Ventilators	464
Safety Shoe Flap	465
Vacuum Arc Furnace	466
Finishing Tools	467
Release Agent	468
Welding Station	469
Actuator	470
Motor Protector	471
Magnetic Particle Testers	472
Cylinder Mounting	473
Hand Lift Trucks	474
Strain Gage Transducer	475
Belt Sander	476
Tractor Shovel	477
Blast Cleaning Abrasive	478
Metal Coating	479
Heat Treat Baskets	480
Rotary Furnace Tilter	481
Shot Blast Machine	482
Shell Core Machine	483
Sand Conditioner	484

Literature for Foundrymen Section (Page 142)

PRODUCT	ITEM NUMBER
Arc Welding	402
Bucket Elevators	403
Optical Pyrometer	404
Stacker	405
Thermocouple Wire	406
Laboratory Equipment	407
Work Gloves	408
Battery Chargers	409
Shotblast Machines	410
Ferroalloys	411
Industrial Silencers	412
Radiography Cameras	413
Gating Zinc Diecastings	414
Insulation	415
Infrared Heating	416
Induction Heating	417
Aluminum Alloys	418
Vibrating Feeders	419
Induction Motors	420
Slings and Connectors	421
Grinders	422
Weight Indicator	423
Centrifugal Fan	424
Relay Conversion Kits	425
Metallurgical Apparatus	426
Diecasting Machines	427
X-Ray Wall Chart	428
Deoxidizer	429
Dock Plates	430
Safety Headgear	431

FOUNDRY

JANUARY 1961

401	431	461	491	521	551	581	611	641	671	701	731	761	791	821	851
402	432	462	492	522	552	582	612	642	672	702	732	762	792	822	852
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BUSINESS REPLY MAIL
No Postage Stamp Necessary if Mailed in the United States
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Thinking of automation?

The Universal Mold Conveyor is typical Jeffrey automation equipment – moves molds on the level, up, down and around.

Jeffrey builds single units and/or builds the entire system

Your men work at elevations best suited to each operation, with the Jeffrey universal mold conveyor on the job. Their tasks are eased and manufacturing efficiency is maintained at high levels, helping to boost earnings.

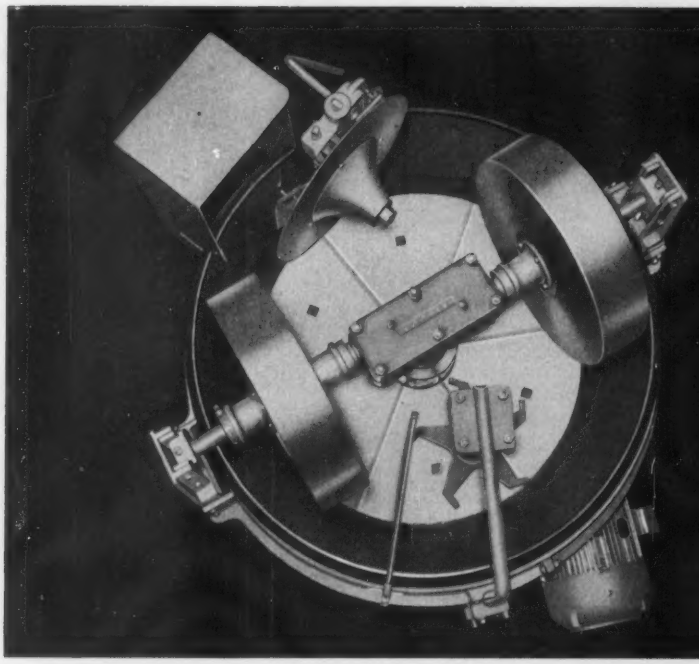
Flow of such materials as sand, castings, coke, limestone and iron borings is handled by Jeffrey vibrating feeders and conveyors, electric or mechanical types. They may serve as cooling conveyors, carrying castings from shakeout, and even the most fragile castings are handled safely.

Jeffrey mechanizes the handling of sand; overhead belt conveyors distribute sand to molders' stations, carry it from shakeout to Jeffrey sand conditioning plant and back to molders. Catalog 911 describes all of this foundry equipment. For a copy, write The Jeffrey Manufacturing Company, 907 N. Fourth Street, Columbus 16, Ohio.

JEFFREY

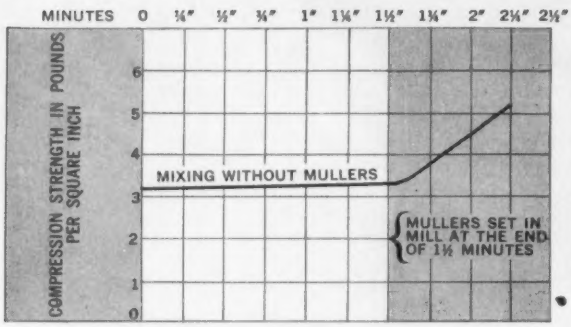
CONVEYING • PROCESSING • MINING EQUIPMENT...TRANSMISSION MACHINERY...CONTRACT MANUFACTURING

Circle 576 on Page 39



Muller Mixing Increases Sand Strength Greatly . . . Rapidly!

Sand Strength Curve Proves the Difference



This Strength Curve Chart demonstrates how much more effective muller mixing of sand is over regular scraper type mixing. In this test a Clearfield mixer was used to mix a charge of 91% burned sand, 3% bond and 6% water. At the start of the run the mulling wheels were removed completely . . . the batch was charged and the mixing operation continued for 1½ minutes with only the disc and agitator operating on the material. *There was only a slight increase in the strength of the sand.* Then the mullers were set into the machine and operation on the same batch continued for 1¼ minutes. During this very short period with the mullers operating, *the sand strength increased very rapidly.* You can speed production, with assured quality results—and cut costs too—with a Clearfield muller-type mixer. *Let us prove the superiority of Clearfield Muller-type Mixers with a sample run of your own batch. Just call us.*

WITH its speed, dependability and special mixing features, a Clearfield Mixer prepares your sand properly and exactly as you want it . . . thus paying for itself many times over. In addition to the strength-building mullers, Clearfield Mixers have other features that assure quality results every time. First, all Clearfield Mixers work on the rotating pan principle so that every particle in the batch is kept in continuous motion, with the ingredients alternately spread and gathered together to maintain highest mixing efficiency.

Another feature is the patented star-shaped agitator which covers the entire flat surface of the revolving bottom and prevents material from forming hard cakes or lumps. The agitator is driven automatically by the force of the sand being rotated by the pan motion; a "whirlpool" action is created, speeding up the mixing process and promoting clean emptying of the pan.

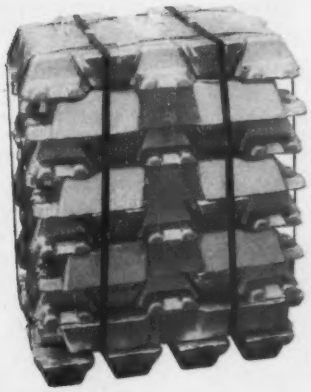
The Clearfield double-duty disc, also patented, cuts all the material free from the revolving pan rim at each revolution, turns it over and diverts a continuous roll of material under the mullers. (Moved to the discharge position, this disc unloads the complete batch in 15 to 20 seconds!)

You get thorough, proper blending and mixing when you use a Clearfield Mixer.

for complete details about the wide variety of Clearfield Mixers, write for Catalog No. 90

CLEARFIELD
MACHINE COMPANY
CLEARFIELD, PENNSYLVANIA, U.S.A.

BENCH MARKS OF QUALITY IN ALCOA ALUMINUM INGOT



1. **Refined—as in a holding furnace or by similar means.**
2. **Clean—free from harmful inclusions, both internally and externally.**
3. **Pure—composition controlled to avoid undesirable metallic impurities.**
4. **Sound—internally solid and externally smooth.**
5. **Uniform—in composition and weight from ingot to ingot, bundle to bundle, shipment to shipment.**
6. **Customized—to meet your needs exactly.**

ONLY FROM ALCOA DO YOU GET ALL 6

Everyone talks about the quality of aluminum ingot, but the record shows that Alcoa *does* more about it. With scientific ingenuity and research dollars, Alcoa has applied realistic control of quality to reduce the costs of finished products. With Alcoa® Ingot, you don't waste time and money in casting and fabricating aluminum, only to lose your investment through later rejection. That's why you get *more* than 16 ounces of metal with every pound of Alcoa Aluminum!

To take the guesswork and risk out of ordering aluminum ingot, rely on your Alcoa salesman. He's got the skills, the experience and the tools—including new literature listing casting characteristics, composition limits and mechanical properties of all ingot alloys. For your copy, just call the Alcoa sales office near you, or write: Aluminum Company of America, 863-A Alcoa Building, Pittsburgh 19, Pa.

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

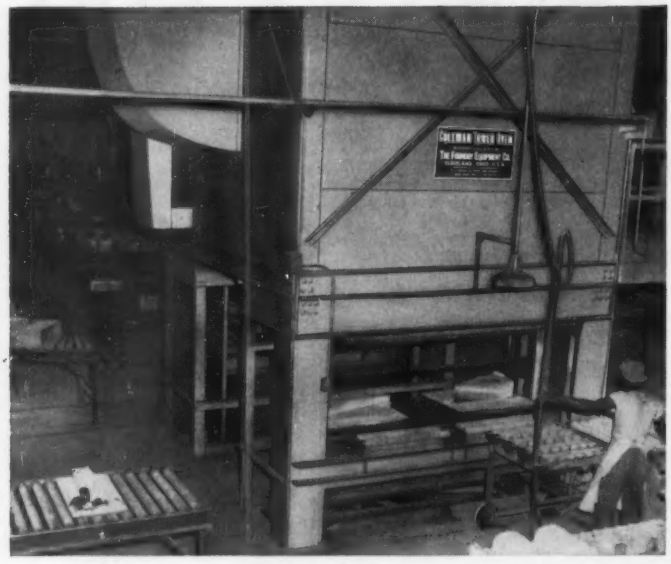
Circle 643 on Page 39

CUT LABOR COSTS

with

Coleman Dielectric Core Oven in leading plumbing fixture foundry. Direct labor alone reduced by 75%, with many other important savings and advantages.

Coleman Conveyor Core Ovens



Coleman Tower® Core Oven. One of two large installations in a major steel foundry. Mechanized handling and baking of cores up to 150 pounds at substantial annual savings.

● **Performance records in all types of foundries prove that Coleman Conveyor Core Ovens reduce core department costs by as much as 50%!**

Coleman Ovens quickly pay for themselves out of direct savings in labor, materials and reduced casting scrap.

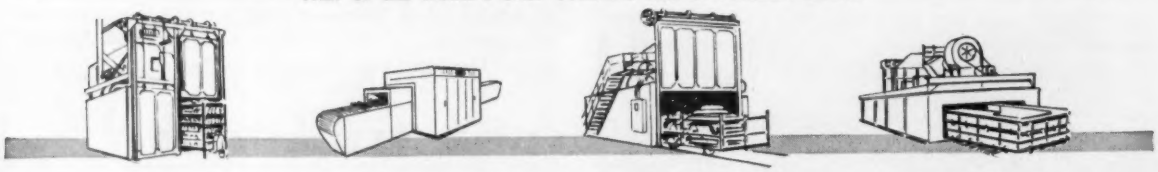
As builders of the world's only complete line of foundry ovens . . . dielectric or recirculating heat . . . we can recommend, without bias, the right oven for your particular needs.

WRITE FOR BULLETIN 54

THE FOUNDRY EQUIPMENT COMPANY • 1821 COLUMBUS ROAD, CLEVELAND 13, OHIO

World's Oldest and Largest Foundry Oven Specialists—More than half a century of specialized foundry experience.

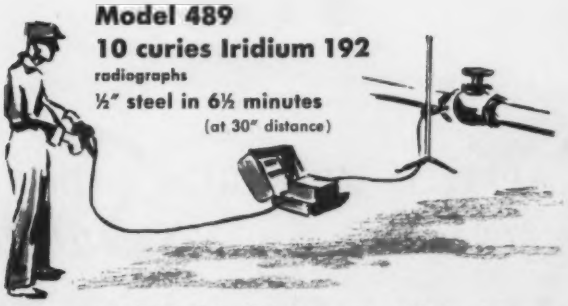
PART OF THE WORLD'S ONLY COMPLETE LINE OF FOUNDRY OVENS



TRANSRACK OVENS | DIELECTRIC CORE OVENS | CAR TYPE OVENS | JET ACTION MOLD OVENS

new roving units for "on-the-job" isotope radiography

at Electric Boat Div. General Dynamics Corp.

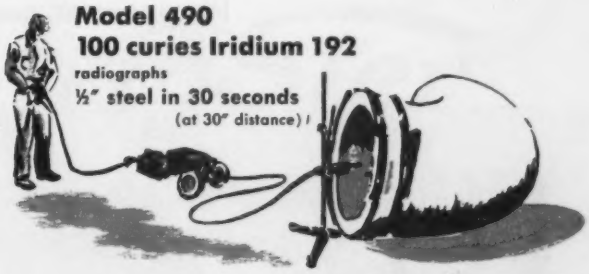


Into a sturdy lightweight fiberglass case no bigger than an overnight bag Tech/Ops has compacted a ready-to-go radiography unit. Complete with a 15 foot control cable and a 14 foot source-guide cable it weighs only 58 lbs.

Its 10 curie Iridium 192 source (5.5 RHM output) will easily radiograph steel sections up to 2" thick in realistic exposure times. Great for pipeline work—it will take the full girth weld of an 8" diameter 1" thick steel pipe in four minutes. Great for radiography in tight spots—the whole works will pass through any opening a man can get through and the snout and guide cable will poke through a 1½" hole.

All this for only $1575.00 complete (without source).

P.S. It will also handle a 50 curie Thulium 170 source if you're inspecting light metals.



Here's a mobile powerhouse—a free wheeling isotope radiography unit that can easily handle the heavy stuff. 100 curies of Iridium 192 (55 RHM output) will radiograph, in one shot, the full girth weld of a 1½" thick steel pipe eight feet in diameter in 6½ minutes.

For all its power the unit is surprisingly lightweight—only 135 lbs. (it has an all-aluminum carriage). Rutty plant yards hold no terrors for the big balloon tires on which it rides. A 25 foot control cable and a 21 foot source-guide cable are carried on a front-mounted reel—pay out easily on the job, coil up smoothly for transport to the next one.

All this for only $2300.00 complete (without source).

For details on these units or any of the other machines or services listed below call any Picker Branch Office (see local 'phone book) or write Picker X-Ray Corp, 25 So. Broadway, White Plains, N.Y.

Picker x-ray

one stop for everything in industrial radiography

ANDREX	portable x-ray units—130 KV, 140 KV, 160 KV, 200 KV, 260 KV
PICKER	x-ray units—35 KV Beryllium window, 90 KV, 150 KV (stationary and mobile), 270 KV portable, intensified image fluoroscopes
TECH/OPS	units for isotope radiography—sources, equipment, containers for Iridium ^{192} Cobalt ^{60} Thulium ^{170} and Cesium ^{137}
ACCESSORIES	. . . films, tanks, darkroom sundries illuminators, *everything*

Circle 579 on Page 39

APPLIED RESEARCH LABORATORIES *Salutes:*

MOTOR CASTINGS COMPANY

...the first Foundry to Use the Quantovac* for the Simultaneous Analysis of All Elements in Cast Iron...including Carbon, Phosphorus, and Sulfur.

*Trade Mark

We congratulate the Motor Castings Company of Milwaukee
for their pioneering application of the Quantovac to the furnace control analysis of cast iron. With this vacuum direct-reading spectrometer, they analyze eleven elements in less than two minutes, with results that are comparable or superior to conventional chemical methods.

ARL Quantovac Laboratory, Motor Castings Co., Milwaukee, Wis.

Ask your nearby ARL representative about the Quantovac for the analysis of iron, steel, stainless, and tool steel. Also ask about the substantial savings that can be realized by eliminating the time consuming wet chemical methods of analysis...or write for full information.

APPLIED RESEARCH LABORATORIES, INC.

subsidiary of BAUSCH & LOMB INCORPORATED

P. O. BOX 1710, GLENDALE 5, CALIFORNIA

MAIN OFFICES: 3717 PARK PLACE, GLENDALE 8, CALIFORNIA • CHapman 5-5524

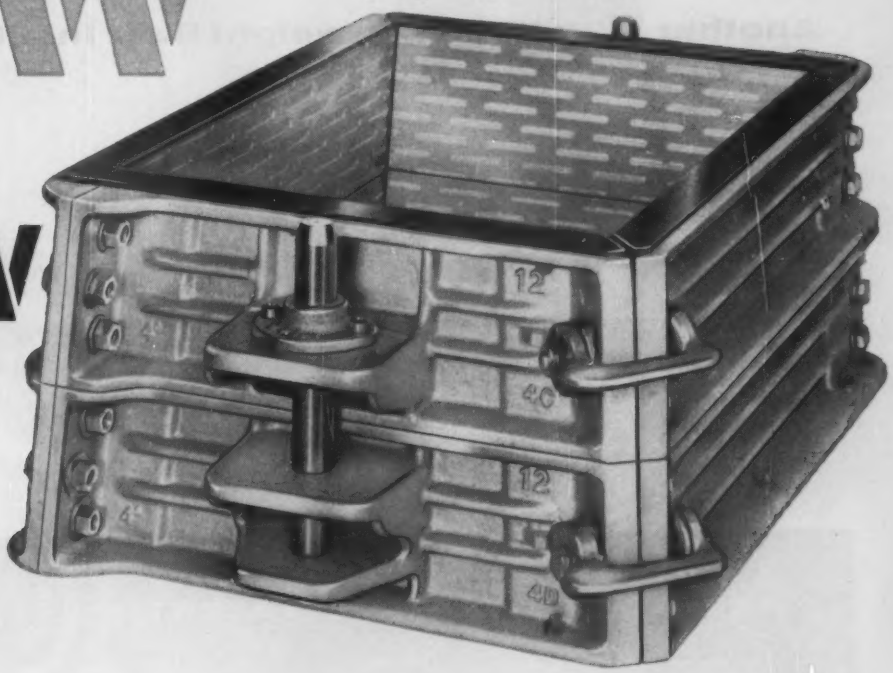
BRANCH OFFICES: NEW YORK • PITTSBURGH • DETROIT • CHICAGO • HOUSTON • LOS ANGELES
LAUSANNE, Switzerland • LONDON, England

Circle 580 on Page 39

Circle 581 on Page 39→

NEW

NEW



NEW

THE STERLING *StripSter*

...with exclusive BALL-AND-CAM closing/opening mechanism

Sterling has taken a new approach to the design of snap-flask locking devices: a ball-and-cam arrangement that locks, and snaps open, with less effort than any other snap flask on the market!

The StripSter also incorporates these features for significantly improved operation and reduced maintenance:

- split cam design reduces physical effort yet provides maximum opening
- shielded-spring sleeve design eliminates frequent lubrication and servicing
- exclusive broad-faced handles assure fast, positive action with minimum hand pressure
- rugged, lightweight aluminum construction conforms to modern foundry standards
- serrated side-walls, 4-degree taper insure rapid positive stripping
- StripSter is completely interchangeable with existing equipment

The Sterling StripSter, of course, can be fitted to meet your specific requirements, including single or double pin closing, hardened steel bushings, handles, trunnions, and upsets as required.

Call your Sterling man today for more information. He'll show you how this significant advance in flask design can benefit your foundry operation.

Sterling

WORLD WIDE SERVICE

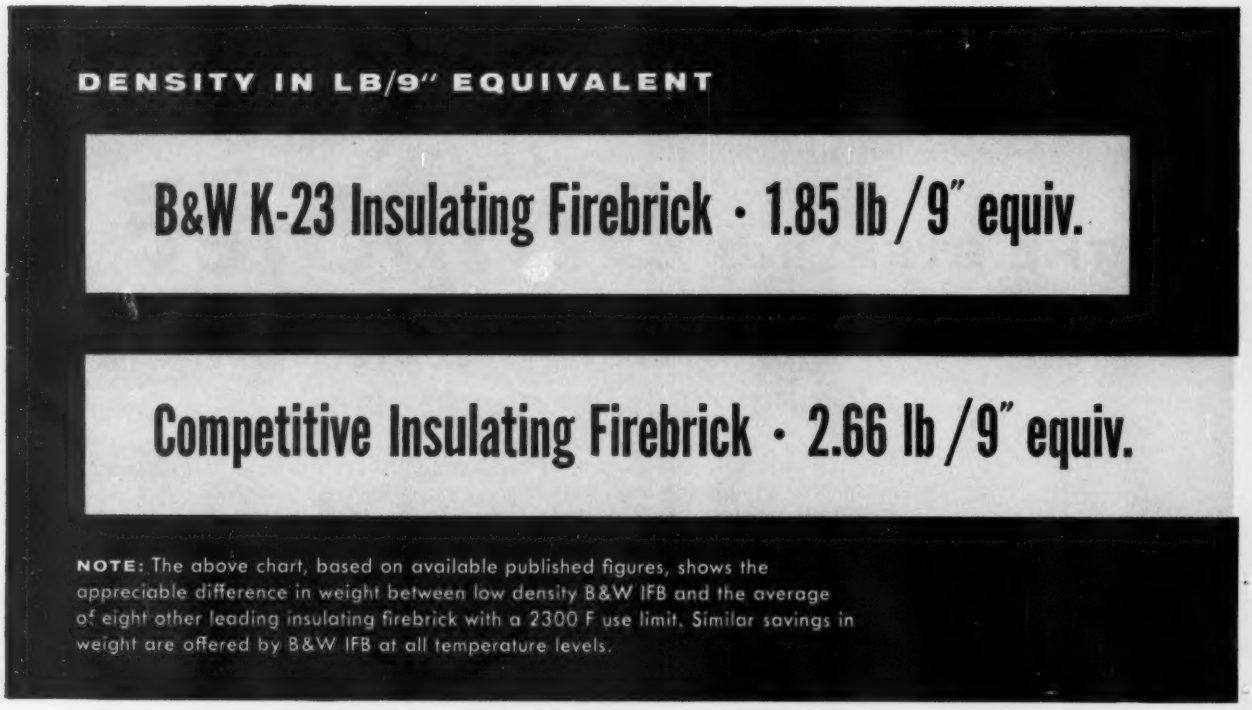
STERLING NATIONAL INDUSTRIES, INC.
Founded in 1904 as Sterling Wheelbarrow Co.
Milwaukee, Wisconsin, U.S.A.

ASSOCIATE: Sterling Foundry Specialties Ltd.
London • Bedford • Jarrow-on-Tyne, England

AD-4545

Another *plus* of Lightweight B&W Insulating Firebrick

LOWER DENSITY means


DENSITY IN LB/9" EQUIVALENT
B&W K-23 Insulating Firebrick · 1.85 lb/9" equiv.
Competitive Insulating Firebrick · 2.66 lb/9" equiv.
NOTE: The above chart, based on available published figures, shows the appreciable difference in weight between low density B&W IFB and the average of eight other leading insulating firebrick with a 2300 F use limit. Similar savings in weight are offered by B&W IFB at all temperature levels.

All insulating firebrick are not the same. Published figures show wide variations in *all* of the important properties among the leading brands of IFB.

Take density. This important property, related to the porosity and the light weight of the brick, affects furnace weight, construction costs, fuel costs, and temperature control. Densities range from a B&W Insulating Firebrick low of 1.85 to a high of 2.80 per 9 inch brick for a competitive Insulating Firebrick—*approximately a 35% difference in dead weight and insulating efficiency.*

You are paying for *insulating* firebrick . . . make sure you get *all* the benefits. B&W—the originator of IFB—manufactures a full line of IFB with an experience-proved balance of light weight, high insulating value, high strength and long life.

For complete information on B&W Insulating Firebrick, write for Catalog R-2-H to The Babcock & Wilcox Company, Refractories Division, 161 East 42nd Street, New York 17, N. Y.

NUMBER 2 OF A SERIES

LESS FURNACE WEIGHT

the payoff

9 TONS LESS WEIGHT to heat and lift in this hood-type, 8 stack annealing furnace. Lined with B&W IFB at 1.85 lb per 9" straight, the refractory lining of this furnace weighs 37,000 lb as compared to 55,200 lb for *average weight competitive IFB*. 33% less weight to heat and lift when you specify B&W IFB. This is just one of many proofs in our files that "there is an important difference in insulating firebrick."

B-659

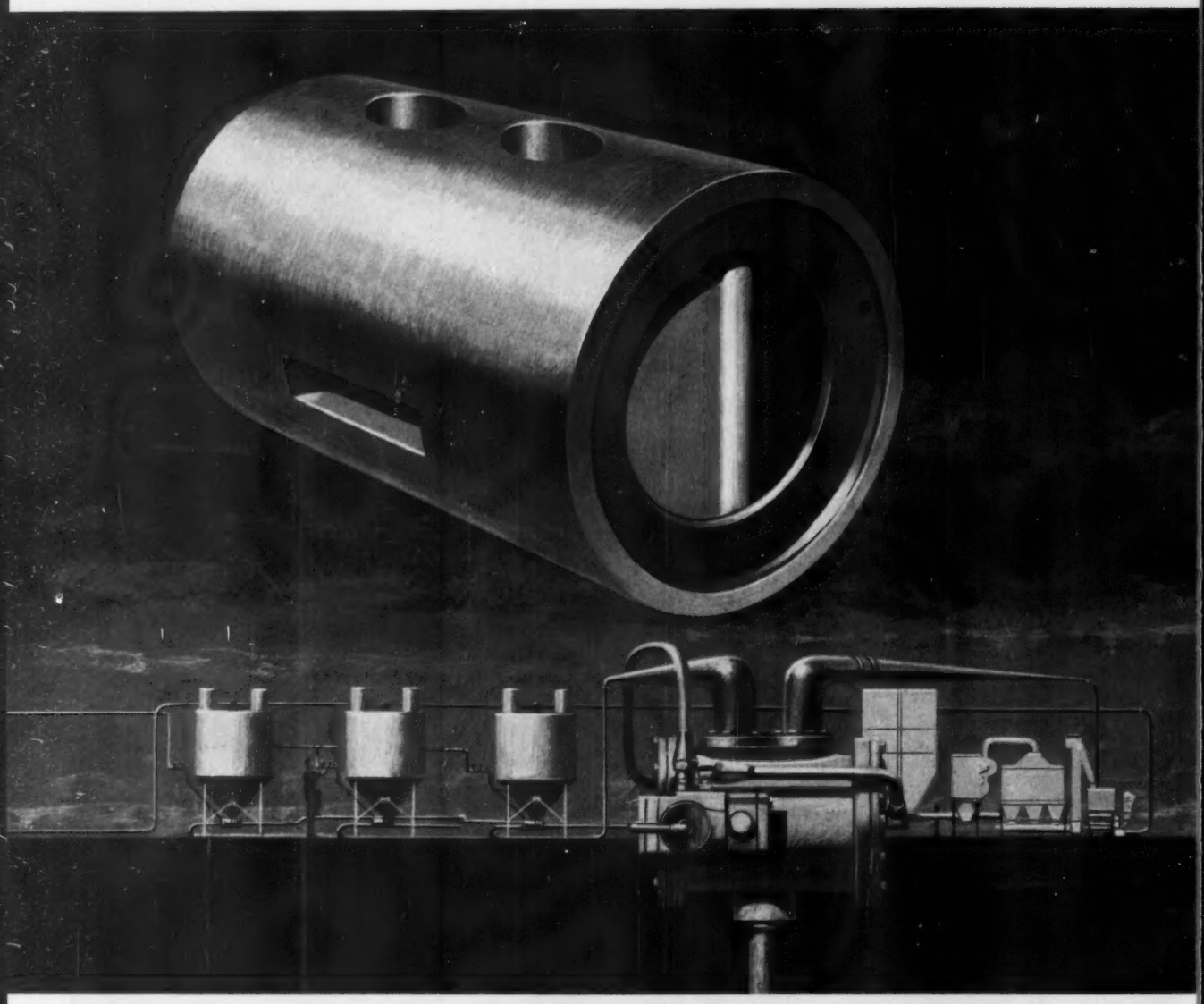
B&W

THE BABCOCK & WILCOX COMPANY

REFRACTORIES DIVISION

Circle 582 on Page 39

How the Foundry Industry Serves America . . . #12 of a Series



CAST IRON PISTON OUTPERFORMS WELDMENT, DROPS COST 55%

The piston in a diverter valve was being made from welded steel tubing and plate at a cost of $61.07—$58.64 of it for machining. Occasionally the welds would crack, causing the piston to stick.

Redesigning the part for a gray iron casting eliminated several machining operations and a stress relieving operation after welding. New cost per piece was just $27.72. Both the rigidity and the appearance of the piston were improved. A more dependable product was realized for less than half the former cost. It's another impressive example of the outstanding performance and economy offered by modern iron castings.

For the production of structurally sound iron castings, Hanna Furnace provides foundries with all regular grades of pig iron . . . foundry, malleable, Bessemer, intermediate low phosphorous, as well as HANNA-TITE® and Hanna Silvery.

Facts from files of Gray Iron Founders' Society

HANNA
THE BEST KNOWN NAME IN IRON

THE HANNA FURNACE CORPORATION
Buffalo • Detroit • New York • Philadelphia

Hanna Furnace is a division of **NATIONAL STEEL CORPORATION**

Circle 583 on Page 39

Readers' Comment

Of Interest to Diecasters

To THE EDITORS:

The writer wishes to compliment you on your November issue of FOUNDRY, and the number of articles and advertising that appeared that would be of interest to die casting users, as well as manufacturers.

I follow your magazine quite closely, and think that you do a very fine job.

GORDON C. CURRY
Vice President

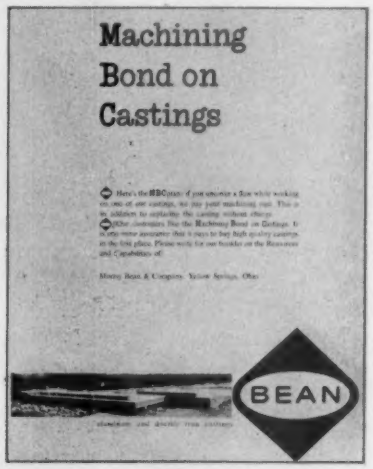
Dollin Corp.
Irvington 11, N. J.

"Quality a Must"

To THE EDITORS:

I have just read with interest your editorial "Quality A Must" in the December issue of FOUNDRY. May I say that your expression for the need to have better control of quality factors in the foundry process is an absolute must with which I completely concur.

Several years ago our company experimented with the idea of giving a guarantee to our customers which would, in effect, pay to them their cost for machining any of



our scrap castings. Our experiences over a period of time clearly indicated that a factory could, and should, accept responsibility for loss incurred because of inadequate inspection.

I am enclosing several copies of a recent advertisement we have run in several trade publications. Within the past month we have changed our selling practice so as to give this guarantee to all of our customers. By doing this, we insure that the customer can determine what his total cost of the product will be before he machines the castings, rather than after he allocates cost for the machining of scrap parts.

With the tools for inspection that are available to the foundry industry today, there is no longer any need for operating on the basis of "make a lot, scrap a lot, and ship a lot." It is our own opinion that quality control in the foundry industry is no more difficult to maintain than in most other manufacturing processes. We believe if more foundries would give a "Machining Bond on Castings" as we do, there would be fewer quotations accepted from those who are unable to provide acceptable quality.

MORRIS BEAN
President

Morris Bean & Co.
Yellow Springs, Ohio

* * *

To THE EDITOR:

Your December, 1960, FOUNDRY editorial, "Quality A Must," certainly would be appropriate any time but is particularly fitting now in the existing "keen razor-sharp" competitive casting market.

Due to the current extended period of low foundry operations, with the rough and tough competition among foundries for the available existing castings work, the pressure of casting buyers for concessions is causing foundries to discard the protection they have had under the compilation of the Terms and Conditions of the Gray Iron Founders' Society. Foundries are accepting bills for salvaging castings which the foundry under normal conditions resisted and would not have accepted.

Inspection divisions are "more finicky" and, as a matter of fact, are becoming unreasonable to arrive at a basis for charge-backs to found-

In the interest of the American foundry industry, this ad (see opposite page) will also appear in

STEEL
IRON AGE
MODERN CASTINGS
AMERICAN METAL MARKET

FREE!

REPRINTS OF THIS AD WITH YOUR FIRM'S SIGNATURE

If you would like to have reprints of this ad to mail to your customers and prospects, let us know. Reprints will have no Hanna product message or signature, but will be imprinted with your firm name and address. Absolutely no obligation. To order your reprints, fill in and mail the coupon below.

The Hanna Furnace Corporation
Detroit 29, Michigan

Please send me_____reprints of Ad No.
(No.)
____of your Foundry Industry Series.
Imprint as follows:

_____

_____

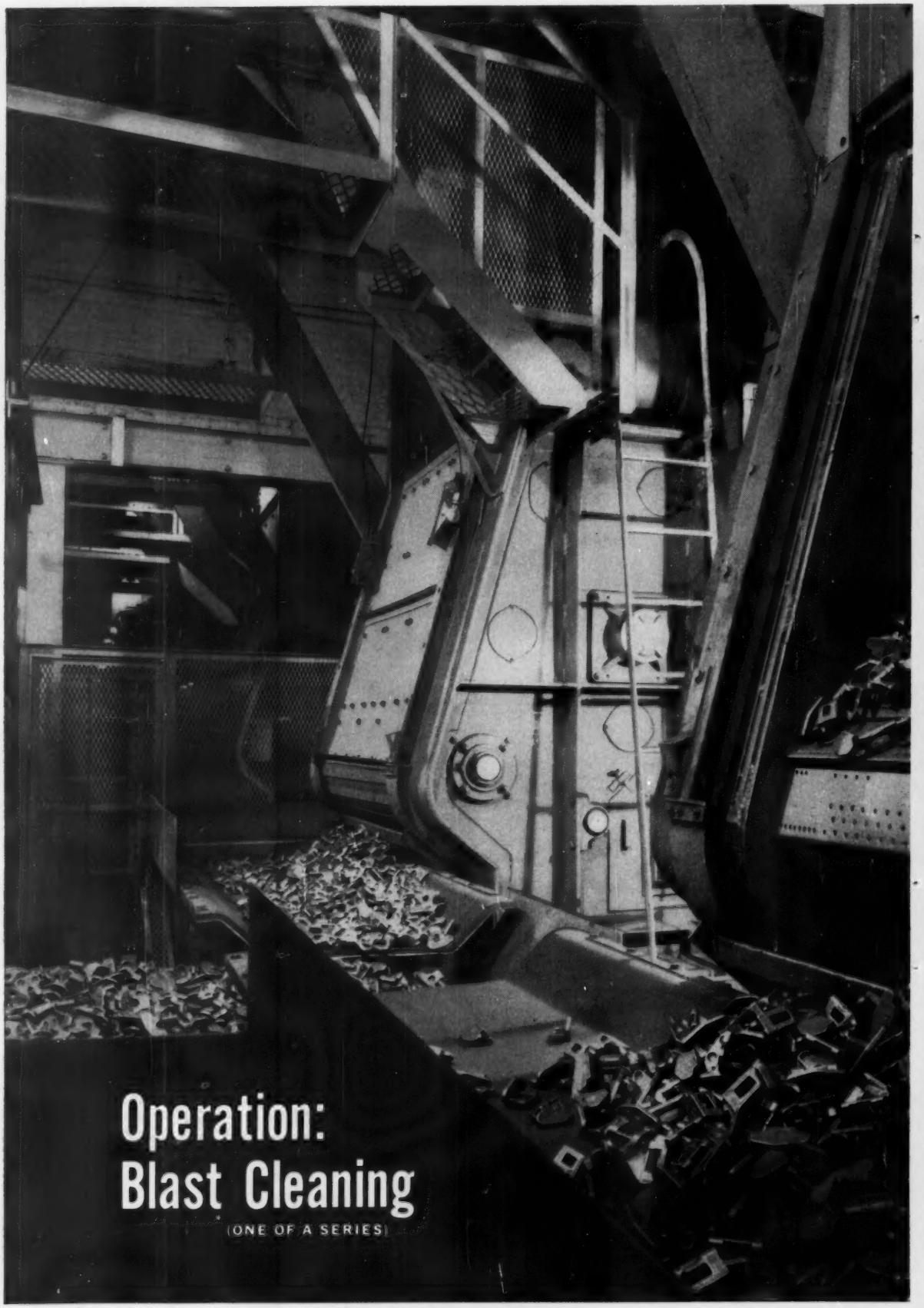
_____

Send reprints to:

NAME_____

I understand there is no charge for this service.

Circle 583 on Page 39



Operation: Blast Cleaning

(ONE OF A SERIES)

Six of seven 32 cu. ft. Rotoblast cleaning barrels stand in line at a large, midwestern automotive foundry. Only two men are needed to operate all six. (Tote boxes in foreground automatically receive cleaned castings.)

BIG JOB, BIGGER RESULTS WITH ROTOBLAST

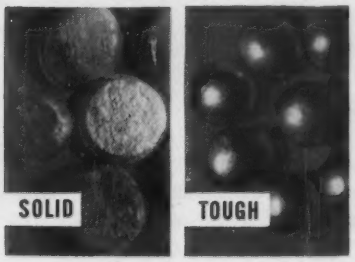
Day in, day out seven heavy duty Rotoblasts work hard at cleaning the tremendous volume of castings produced at a large, famous automotive foundry in the Midwest. At last count, each of the seven barrels had accumulated more than 600 hours of actual blast time with practically no need for maintenance or repairs.

Proof of the almost completely automatic operation of these machines is that just two men operate a line of six! (The seventh has a separate location for materials handling convenience.)

Whether your cleaning needs are big or small, Rotoblast has a standard unit for the job or can provide specially designed equipment. Labor-saving automation can be built into a single, small unit just as easily as into seven big ones.

We'll be glad to go into more detail. Just write: PANGBORN CORPORATION, 1400 Pangborn Blvd., Hagerstown, Md. *Manufacturers of Blast Cleaning, Vibratory Finishing, Dust Control Equipment—Rotoblast® Steel Shot and Grit©.*

Try Rotoblast abrasives, too!



A special, heat-treating process makes Rotoblast Steel Shot and Grit solid, tough, able to take more punishment than ordinary abrasives. Because they are *extra* tough, Rotoblast abrasives last longer, work harder and lower your replenishing costs.

Pangborn
OF HAGERSTOWN

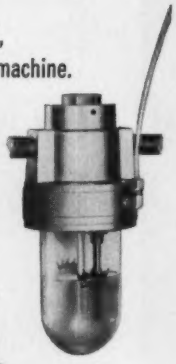
Circle 577 on Page 39

HANNIFIN *Crown*

delivers air the way you want it!

With "Crown" remote controlled units, you can filter and drain overhead air lines, control regulators from below, and fill lubricators without climbing. Or, with our completely standard units . . .

. . . you can provide just the right amount of filtered, regulated and/or lubricated air right at your machine.



NEW! PULSE-LUBE . . . for off-beat air flow

If air flow is uphill or light or so infrequent that air-borne lubrication won't solve your problem, you can deliver oil just where you need it, in the exact amount you need, through a tiny flexible tube with new "Crown" Pulse-Lube . . .

All these "Crown" developments are detailed and described in a new, comprehensive "Crown" catalog (our Bulletin 0400-B1). We'll be happy to send you one.

PARKER HANNIFIN CORPORATION

HANNIFIN COMPANY
A DIVISION
637 South Wolf Road • Des Plaines, Illinois
PNEUMATIC AND HYDRAULIC SYSTEM COMPONENTS

3071-PH

ries to hold or reduce their own costs in processing operations.

I can assure you from my own observations that quality requirements by buyers now are on a higher plane for the same castings than previously.

PETER E. RENTSCHLER
President

Hamilton Foundry Inc.
Hamilton, Ohio

The Shell Core Series

To THE EDITORS:

I have just finished reading the various articles on shell cores in your October issue. I think they are very well done indeed and very fair in regard to the advantages and disadvantages of shell cores.

I feel sure that this series of articles will tend to stimulate a further increase in the use of shell cores.

R. E. DODD

Durez Plastics Div.
Hooker Chemical Corp.
North Tonawanda, N. Y.

Omission in Article

To THE EDITORS:

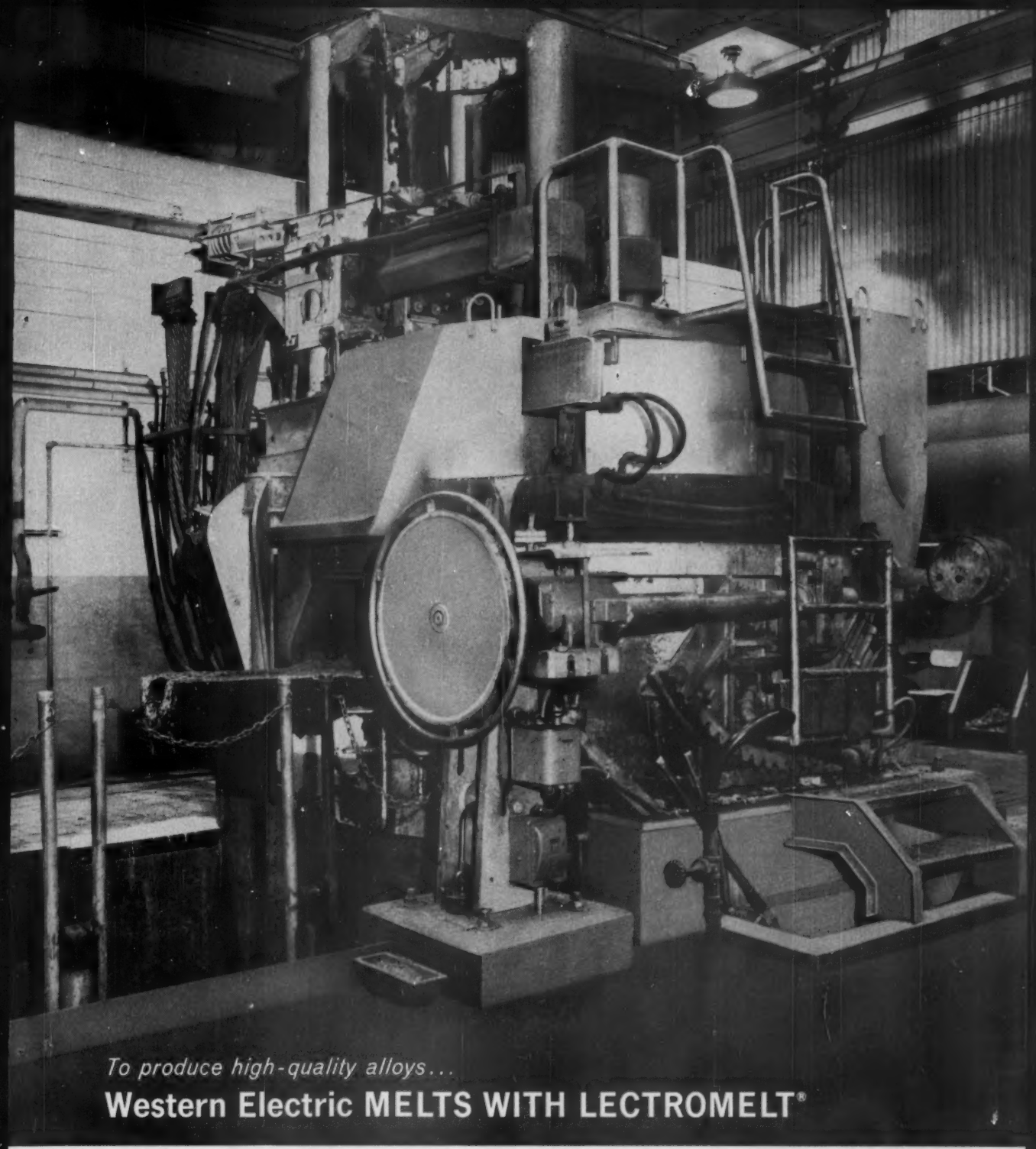
With regard to my article "Some Mechanical Properties of Cupola Malleable Iron," appearing in October FOUNDRY, Page 110, I would like to call your attention to the partial exclusion of a sentence due to a typographical error in my manuscript.

The paragraph in question appears on Page 113 under the heading "Hardness vs Tensile Strength." The sentence reads as follows: "It is worth mentioning that in gray or white irons Brinell hardness increases with the increase in T.C. (and also C.E.) because a higher T.C. value gives more primary cementite. And all the . . ."

This sentence should read: "It is worth mentioning that in gray or white irons Brinell hardness increases with the increase in T.C. (and also C.E.) because a higher T.C. value gives more primary cementite, if the metastable state could be retained. All the carbon . . ."

JOSHUA PELLEG
Metallurgical Engineer

Urdan, Metallurgical Works Ltd.
Natanya, Israel



To produce high-quality alloys...

Western Electric MELTS WITH LECTROMELT®

To produce Permalloy® and other high-quality cobalt-nickel alloys, Western Electric Company Incorporated has among its installations a Lectromelt "PT" furnace at its Hawthorne plant in Chicago. This 9-foot furnace makes 7-ton heats with the high degree of uniformity Western Electric must have for its exacting needs. Dependable Lectromelt Furnaces – with such features as fast top charging ...accurate control...rapid melting cycles – make high availability possible. To find out how these furnaces can boost your production, get in touch with Lectromelt – world's largest exclusive manufacturer of electric furnaces. Lectromelt Furnace Division, McGraw-Edison Company, 314 32nd Street, Pittsburgh 30, Pennsylvania.

WHEN YOU MELT... Lectromelt McGRAW EDISON

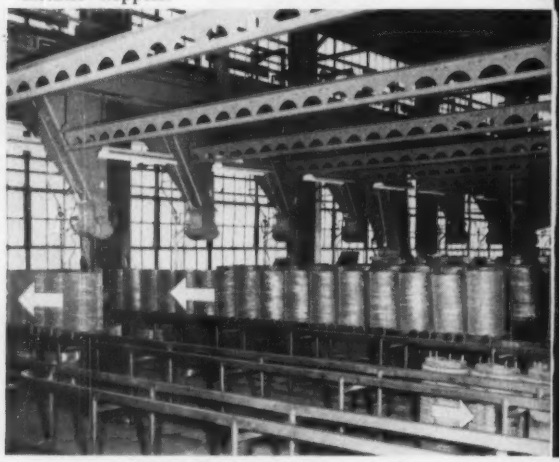
Circle 586 on Page 39

This Newaygo Sand System with Newago's **MULTI-LEVEL CONTROL,** installed recently at SEALED POWER CORPORATION, Muskegon Heights, Michigan automates a high production system for small gray iron castings suitable for a stack molding process. Circular sand storage bin, with Newaygo Plate Feeder, feeds sand to skip hoist for loading the muller. Operations from tank, through muller to distribution belt, are controlled by the Newaygo specially designed combination Motor Control and Multi-Level Panel, which works in conjunction with a No. 3917 Dietert "End Point" Moisture Controller and Automull. This allows fully automatic operation of sand handling system, from shakeout to molders' hoppers.

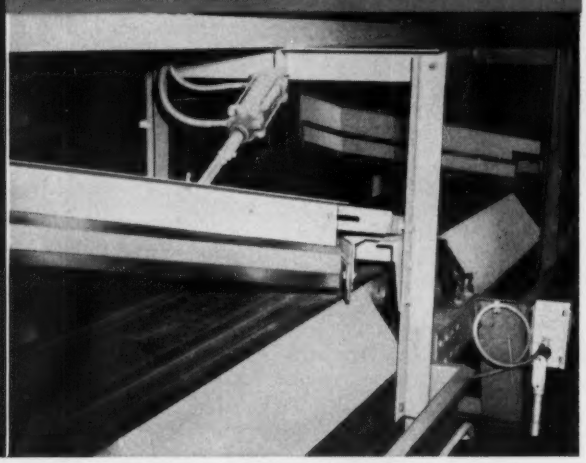
Foundries step up ***QUALITY*** *of castings and* ***QUANTITY*** *of molds with* **NEWAYGO** *equipment!*

More molds ON THE MOVE make money! Automation by Newaygo keeps molds on the move!

Here's MORE proof of Newaygo's Leadership in "packaged" sand handling units!



Portion of the 12-hopper molding line. This is a stack molding operation, with empty flasks returning to molder on dolly cars at high level. The same dolly cars are used to take a stack of unpoured molds through the pouring zone, with tracks at floor level.



Each hopper has fully automatic sand filling through the use of the Newaygo Multi-Level Control System.

"The automation of our small casting department has more than doubled our capacity in the same floor space. We have made significant cost reductions and have attained a high and predictable level of quality. Newaygo has contributed excellent equipment plus engineering assistance and know-how to make this program a success." — John A. VanHaver, Foundry Manager, Sealed Power Corporation.

Write, phone or wire for a Newaygo Representative to help you.

These will help YOU

MOVIE "Progressive Mechanization", featuring HANDY SANDYS in 9 foundries . . . . MOVIE "Newaygo Pallet Systems for Mold Handling", many types of installations in foundries . . . . Our magazine "SAND SCRIPTS" . . . Bulletins: No. 60 on Pallet Line Systems of Mold Handling . . . No. 59 on HANDY SANDYS . . . No. 56 on Newaygo Sand and Mold Handling, and Mold Making Equipment.

Performance and durability are built into every piece of NEWAYGO equipment.

NEWAYGO engineering company
NEWAYGO, MICHIGAN

. . . and profitable, too, with NEWAYGO MOLD HANDLING, SAND HANDLING AND CONDITIONING EQUIPMENT

Also Manufacturers and Installers of MULTI-LEVEL HOPPER CONTROL SYSTEMS, CAR CONVEYORS, APRON CONVEYORS, ROTARY FEEDERS and FOUNDRY AUTOMATION

WHEREVER METALS ARE CAST . . . FOUNDRY
JANUARY 1961

Let's Do Both

This is the customary time of year for economists, scientists, and businessmen to predict what lies ahead for industry, trade, and technology. Probably the safest prediction anyone can make is that changes will occur in all three directions, because change is characteristic of today's economy and industrial science.

The likelihood of future changes in the foundry industry is emphasized by a panel of foundrymen and educators who responded when FOUNDRY asked them, "Where is the industry's technology headed?" Their comments, starting on Page 68 of this issue, lead to these conclusions:

1. Much remains to be learned about various fundamentals of casting practice.

2. Changes in practice will be necessary if foundries are to improve their competitive position with other products.

3. Foundrymen tend to resist changes.

Here are only a few of the fields which these authorities say require attention:

- Much fundamental work on fluid flow remains to be done, and then the knowledge will have to be applied to practical engineering ends.
- We need to know more about gas control as it is related to normal melting problems.
- A great shortage exists of qualified men with adequate ceramic background for effective work in the improvement of molding media.
- The chemical and physical nature of mold-metal interface behavior is a rich field for study.
- Considerable progress has been made in improving surface quality and dimensional accuracy of castings, but more improvement is needed.

The need for these and other investigations—many of them long overdue—is obvious. It is equally important that foundries overcome the apathy which has delayed changes in operating practices based on technical improvements.

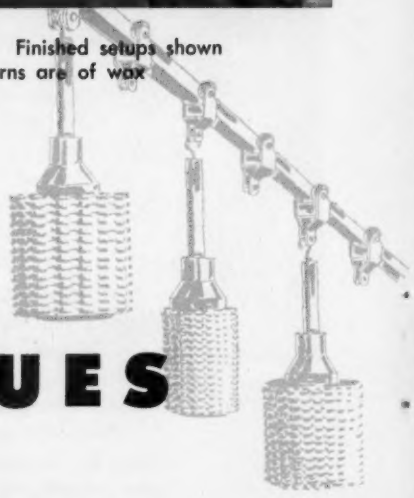
Nevertheless, foundries today *can* offer convincing arguments for the superiority of castings over other products for many applications, and the means are available—*if used properly*—for backing these arguments with a quality product.

We must look to the future, but for the present it's a matter of more effective selling of what we have.

William G. Gude

Editor

Operators at left are wax-welding patterns to hollow sprues. Finished setups shown at right in foreground have plastic patterns; the other patterns are of wax



Increases Yield By Using

HOLLOW SPRUES

The hollow sprue technique for investment molding increases casting yield as much as 300 per cent. It is a major achievement in a series of technological advancements made by this foundry

By ROBERT H. HERRMANN
Associate Editor

● A REVOLUTIONARY development in gating practice has enabled Precision Metalsmiths Inc., Cleveland, to increase casting yield as much as 300 per cent. The use of a hollow sprue to replace the conventional solid sprue makes the improved yield possible. Claude H. Watts, director of research for PMI, developed the process which is protected by the necessary patent application.

He says, "In addition to improving the ratio of castings to metal poured from a low of 1:9 to a high of 1:2, we are getting castings with uniformly better quality. We also are able to get as many castings on one investment shell pattern setup as we used to get with three or four of the solid sprue setups."

"And when you consider that our new conveyorized mold making line turns out two and a half times more molds per manhour than we could make by former methods, we really have increased our production potential," adds Leo E. Carr, manager of special projects.

Company President Robert R. Miller summarizes these comments from the management point of view: "We now can offer our customers castings of a higher level of quality and uniformity on more favorable terms."

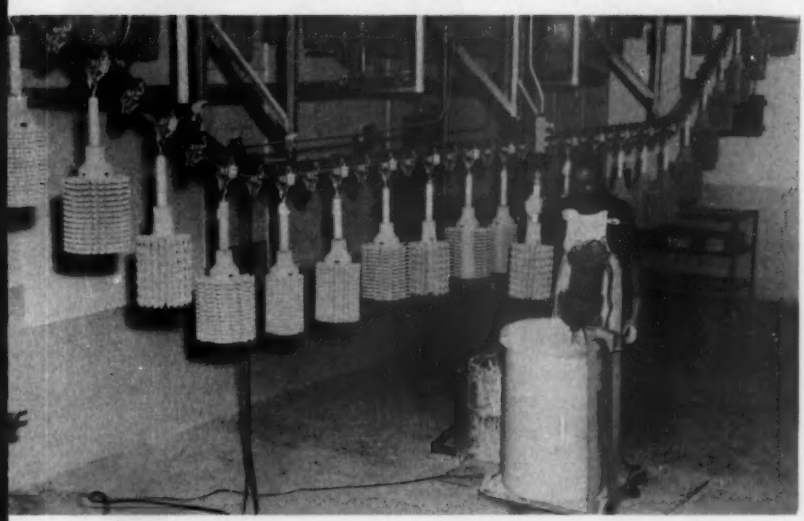
Closeup of setup assembly operation. An electric tool with a thin, flat blade is used to wax-weld gate stubs of the casting to the sprue

The Hollow Sprue—The sprue is a simple cylinder 12 to 14 in. long and having a tapered wall section. Two basic wall sections are used: One tapers from 1/8 to 1/4 in., the other from 1/4 to 3/8 in. The thickness used depends mainly on the alloy being cast. Sprues of three diameters, 4, 6, and 8 in., are being employed. The size of casting being produced, the number desired on one setup, and whether shell investment or solid flask molds are to be made, are factors determining the sprue diameter which is used.

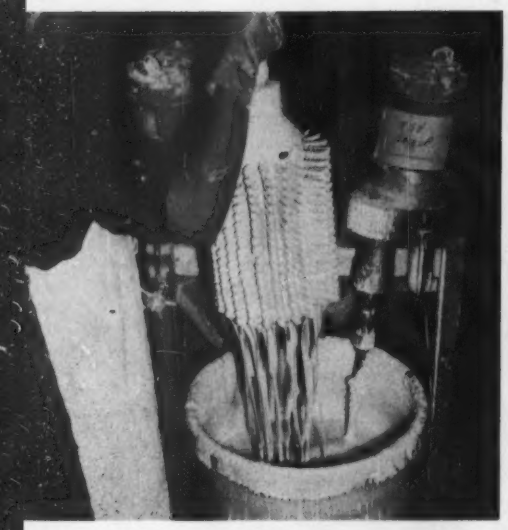
The sprues are of wax. They are wax-welded to a wax pouring basin former, and the assembly is similarly attached to a wooden base plate. It steadies the sprue during attachment of patterns around the outside surface of the cylindrical sprue and facilitates handling the finished setup to the mold-making area.

Hollow sprue setups with wax or plastic patterns are used in making either shell investment or solid molds, provided, of course, that previous consideration is given to pattern spacing and arrangement suitable for the type of mold to be used. A wide variety of ferrous and nonferrous castings is produced in both types of molds.

Ninety per cent of ferrous castings production at PMI is in ceramic shell investment molds, and



Use of this mold drying monorail conveyor for making shell investment molds has upped rate of mold production about 250 per cent



Ceramic shell investment molds are made up of alternate coatings of fine refractory slurry and coarser refractory stucco. Pattern setup is dipped in slurry tank at left and in fluidized bed of stucco material at right

about 70 per cent of pattern setups are built on hollow sprues. Since all new jobs brought into the foundry are engineered for casting in shells, production equipment and handling techniques are designed almost exclusively for the shell investment process.

For example, a metal nut is embedded in the base of the wax pouring basin former. A bolt in one end of a wooden handle is screwed into the nut to facilitate dipping in the mold slurry and application of granular refractory (stuccoing) during mold making. An eye bolt in the other end of the handle permits hanging the setup for drying the five to seven slurry-stucco coatings required to make the ¼-in.-thick ceramic shell.

Mold Making—Company engineers believe that the newly installed monorail conveyor for producing molds is a first in the industry. It has reduced the handling and rehandling of pattern setups considerably. The average production rate of a mold every three minutes off the conveyor line is about 250 per cent faster than that formerly obtainable. The former method, not yet completely replaced at this foundry, involves the hand carrying of setups between the drying racks and dipping and stuccoing operations after each mold coating.

The mold-making conveyor line is operated by one man. He dips a pattern setup in a paddle-agitated tank of mold slurry and allows it to drain briefly. He then hangs the setup by the eye bolt on a hook which is rotated rapidly by electric motor to throw off excess material. The setup then is lifted from the spinner and immersed in a fluidized bed of granulated refractory to stucco the slurry coat. The worker hangs the setup on a hook of the monorail conveyor.

The conveyor indexes 18 in. every minute and makes a complete loop in about 1 hr. Hooks are mounted on 9-in. centers along the conveyor. That adds up to 120 hooks and, consequently, 120 shell investment molds in 6 hr on the basis of an average of six slurry-stucco coats per mold.

The slurry consists of water-base silica sol binders and fused silica flour refractories of minus 325 mesh. The stuccoing material is fused silica grog of nominal 30 mesh. The tank in which this material is contained has a false bottom formed by a porous ceramic plate. The actual bottom of the tank is 6 in. below this. Compressed air at 6 in. Hg is introduced into the chamber and flows through the porous plate at 100 cfm to agitate the refractory so that the grains move in all directions and thus uniformly coat all exposed surfaces of the setup.

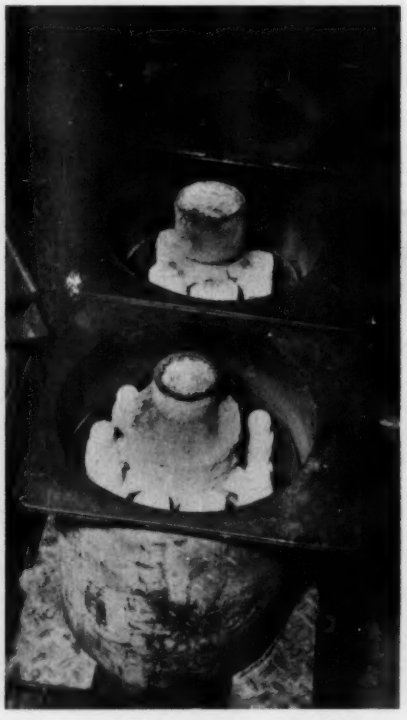
The slurry-stucco coatings are dried in a gentle air stream provided by fans during the hour-long travel of the conveyor. When the final coating has dried, the invested setups are removed from the hooks of the conveyor and the handle unscrewed from the nut in the base of the pouring basin.

Molds are made in a room in which temperature is held between 72 and 78° F and below 60 per cent relative humidity. The constant temperature prevents expansion and contraction of the wax or plastic patterns, thus avoiding possible cracking of the ceramic shell investment molds. Low humidity provides optimum conditions for drying the slurry-stucco coatings.

Heat-disposable pattern material is melted out of the molds in ovens at 1800° F. This requires 7 to 15 minutes. The molds are transferred to other ovens where they are kept at 2000° F for at least 1 hr prior to pouring. Molds are poured in air or in vacuum chambers. In either case they are nestled in coarse sand to hold them upright.

The vacuum chambers are open-

Molds are poured in small chambers under a partial vacuum of 1 to 5 in. Hg, as desired



top units. A steel plate and an asbestos gasket, each with a hole in the center, are used to form a seal between the neck of the mold and the chamber. A partial vacuum of 1 to 5 in. Hg, as desired, is developed in the chamber during the pour.

Subsequent removal of the cast from the mold, castings from the gating metal, finishing, and inspection procedures are standard.

Hollow Sprue Advantages—More castings can be produced per setup per manhour, and the castings are of higher quality than those produced with traditional sprues. The high ratio of castings to metal poured saves metal and melting cost and reduces handling in production; one hollow sprue setup will produce as many castings as three or four traditional solid sprue setups.

Pattern melt-out and mold burnout cycles are shorter because of the absence of a massive sprue and because of the increased mold area exposed to the heat of the oven. Also the vacuum chamber assist to mold cavity filling is more effective. Consequently, the partial vacuum need not be as great as that required previously.

Metal in the mold freezes rapidly. Although fast freezing generally occurs in all ceramic shell investment molds, the freezing is even more rapid in the hollow sprue mold because absence of the massive sprue reduces the thermal gradient in the mold.

Practically no decarburization occurs in the castings. Hardness as indicated by Rockwell tests has a high degree of uniformity over the entire casting surface. Defective castings resulting from short fill and gas porosity have been reduced considerably.

Fast freezing and a low thermal gradient are believed to be important factors in the improvement of quality and uniformity of the castings. Freezing of castings is so fast that a heavy sprue serves no purpose as a liquid metal source. Hollow sprue wall sections sometimes are thinner than sections of castings, yet casting soundness is better than it is in castings made with conventional heavy sprues.

Lower Casting Cost—The hollow sprue technique is the second major technological development by PMI in the past year to contribute to lower cost of cast parts sold to customers.

The other development involved formulation of a refractory stucco-slurry system that would produce a shell investment mold with expansion characteristics compatible with those of plastic patterns. Thus the production and cost advantages of plastic patterns could be combined with similar advantages of the hollow sprue ceramic shell investment process to make today's cost of identical castings substantially lower than the cost in 1951. In some instances a 30 to 45 per cent saving has been realized.

The advantages of plastic over wax include pattern production rates five to ten times faster, sharper detail, greater durability and dimensional stability, and raw material cost considerably less than that of wax. A disadvantage is that the use of plastic is restricted to simpler patterns. Wax generally is best for complex patterns.

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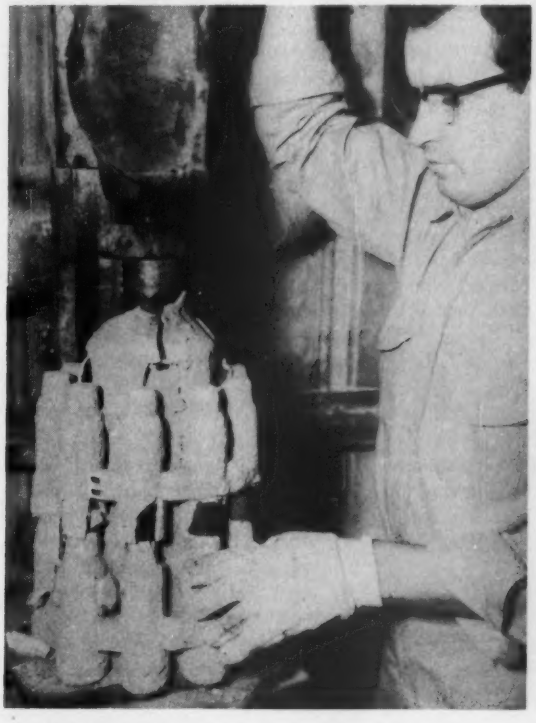
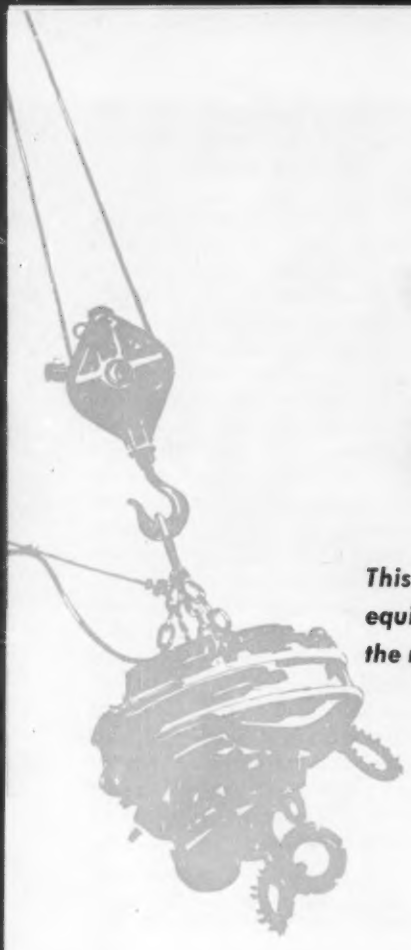
Ceramic material of the mold is broken away from the cast setup by applying the head of a pneumatic vibrating hammer against the top of the sprue



Cast setups are wheeled on two-shelf carts into the cleaning room where any adhering mold material is removed by blast cleaning or in hot salt baths



Handling Materials With MAGNETS

This malleable iron foundry makes extensive use of bridge cranes equipped with lifting magnets for handling metal and castings in the melting, cleaning, and heat treating departments

By ROBERT H. HERRMANN
Associate Editor

● EXTENSIVE USE of bridge cranes equipped with lifting magnets for handling metal and castings is a feature of the melting, cleaning, and heat treating departments in the malleable iron foundry of I-F Mfg. Co., New Philadelphia, Ohio.

Most of the castings produced here are used for pipe wrenches, pipe vise stands, and for die heads. Average weight of malleable castings produced is 3½ lb, and output is about 450-500 tons a month.

Iron is melted in six low-frequency induction furnaces situated in a line across one end of the molding bay. These furnaces, of 5000-lb capacity, are fitted with a top cover having a large hook eye mounted over its center. The furnaces are charged with an electromagnet suspended from an operator-controlled bridge crane.

Charges consist of 300 lb sprue and returns, 125 lb steel scrap, and 75 lb pig iron. The materials are weighed on a scale platform from which they are picked up by the magnet. The crane operator then positions the crane beam over the furnace to be charged.

Unusual Charging Method—The magnet and a hook are suspended by separate cables from the electrically-propelled dolly of the crane. Each, however, may be raised and lowered independently. The operator lifts the furnace cover with the hook, and moves the crane dolly forward, positioning the magnet over the furnace. With the magnet lowered close to the bath in the furnace, little splash occurs when the magnet is de-energized to drop the charge.

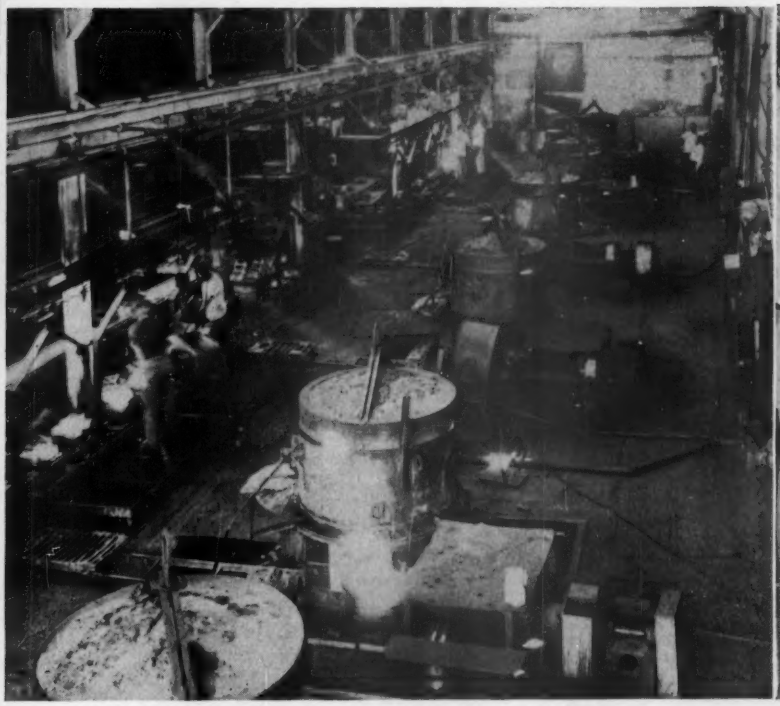
The lid is replaced on the furnace and the crane travels to the end of the line of furnaces adjacent to the cleaning room. There the magnet is used to pick up sprue and returns from a bin and carry them to the other end of the furnace line to a sloping bottom bin from which the metal is raked to the charge make-up scale.

Molten iron is tapped at 2950° F to 1000-lb capacity covered ladles which rest on dollies traversing floor rails. The ladles are pushed under the furnace spout for filling, then pulled away from the spout to a point under a monorail paralleling the mold conveyor. An electric hoist is used to lift and carry the ladle for pouring molds.

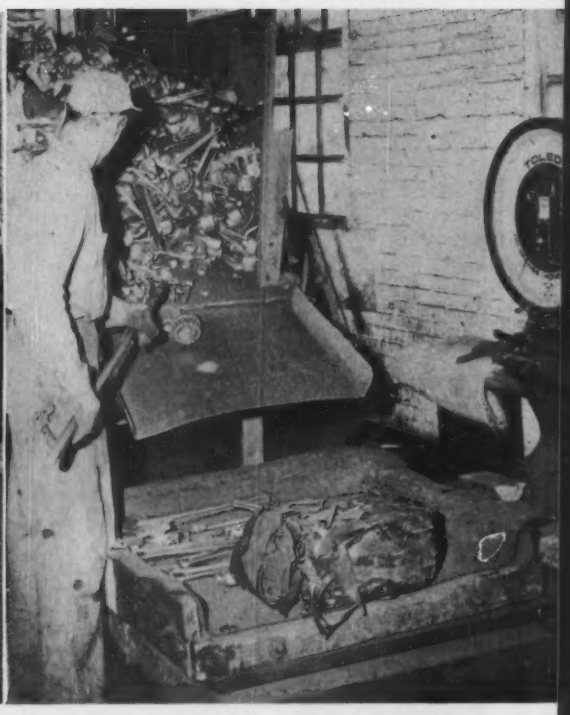
A crane operator, a furnace man, and a charge make-up man handle the complete iron melting operation.

Cleaning and Annealing — A waist-high apron conveyor carries castings from shakeout through a continuous airless blast cleaning machine and past workers who degate, inspect, and sort the castings into tote boxes. Gating metal is dumped off the end of the conveyor to a bin in an adjacent bay of the building. Here a bridge crane equipped with a lifting magnet moves gating metal and scrap castings to a chute which supplies the storage bin in the melting area.

Tote-box loads of castings are trucked into the cleaning-annealing bay and dumped on the floor. The crane with magnet moves castings to chutes which supply the several double-end stand grinders used to snag off gate stubs. Similar chutes

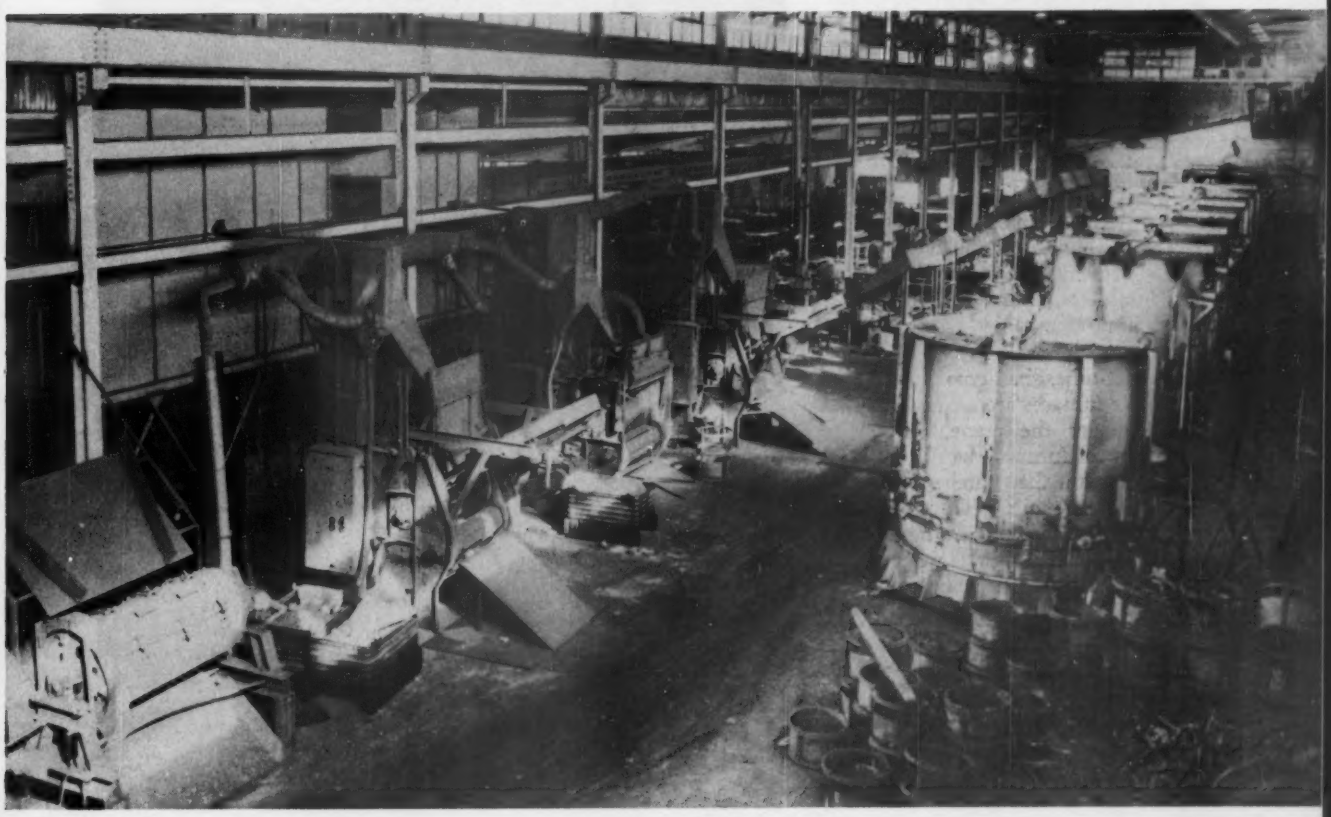


Melting and pouring floor. Each low-frequency induction furnace has a melting capacity of 5000 lb



Platform scale is used to weigh charge made up of sprues and returns, steel scrap, and pig iron

Chutes leading both into and out of tumble and blast units, left, facilitate handling of castings by electromagnets. More chutes can be seen in the background where they are used to supply grinding machines. At the right are gas-fired annealing furnaces



Workers load castings to be annealed into round metal baskets. These containers are stacked three high and are held in position for movement to a furnace by a special bail which is engaged and lifted by the hook of the bridge crane.

The same bail is used for unloading baskets of annealed castings from the furnace base to the floor. The bail is removed and the baskets are tipped by the crane and hook to dump the castings on the floor. Then, with the magnet attached, the crane transports the annealed castings to the airless blast cleaning machines.

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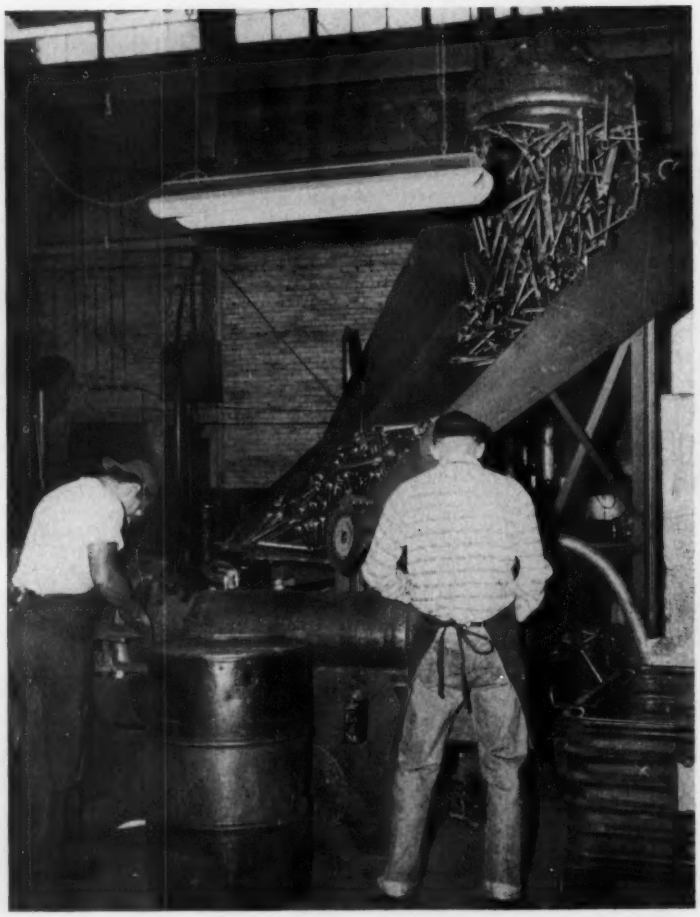
Magnet is used to charge the furnace as shown here. Very little splash occurs when the charge drops because the magnet is close to the bath

This magnet is delivering castings to a stand grinder where gate stubs will be snagged off. A bridge crane supports and controls the magnet



direct castings to airless blast tumbling machines and to tumbling barrels.

Castings cleaned in these machines are discharged to the floor. The crane with magnet picks them up and transports them to chutes over final inspection tables.

Castings are annealed in gas-fired, radiant-tube, bell-type furnaces. These furnaces are arranged in a line under the crane, and the number of furnace bases is one greater than the number of bell-type furnace shells. This arrangement makes available a base for unloading and loading while the other furnaces are at temperature.

The furnace shells, which contain the radiant tubes, connections for gas hoses, and temperature controls, have a hook eye at the top. This hook is engaged by the hook of the crane which moves the shells from one base to another.

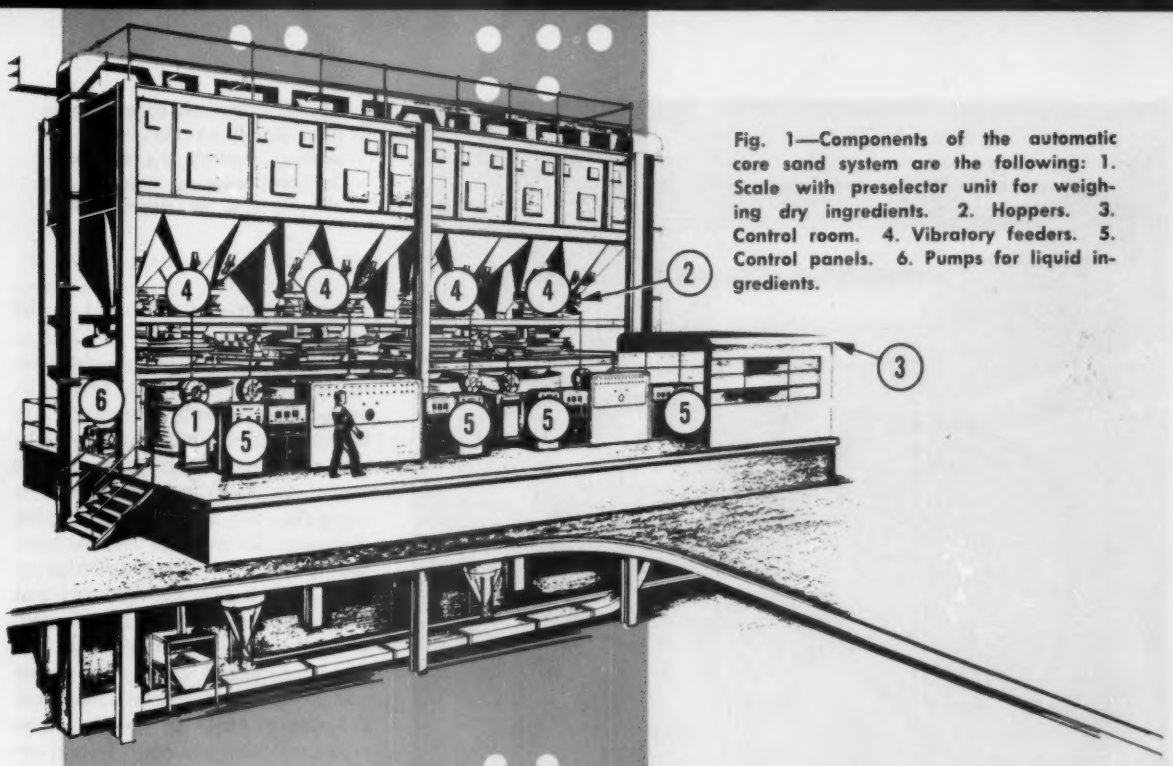


Fig. 1—Components of the automatic core sand system are the following: 1. Scale with preselector unit for weighing dry ingredients. 2. Hoppers. 3. Control room. 4. Vibratory feeders. 5. Control panels. 6. Pumps for liquid ingredients.

Punched Cards Control

Automatic Sand System

● Automatic core sand preparation has proved successful for this English foundry. Its system is producing one ton of core sand every three minutes

By LEO WALTER
Consulting Engineer
Painswick, England

● MORE than two years of operation has proved the efficiency and reliability of a system for automatic proportioning, mixing, and handling of foundry core sand in the Thames foundry of the Ford Motor Co., Dagenham, England.

This foundry is highly mechanized (see FOUNDRY, August, 1958), and the automatic system is essential for handling a large volume of core sand.

The problem was to provide for a minimum daily production of 350 tons of bonded core sand, allowing for 25 per cent overload. A time allowance of three minutes for proportioning a one-ton mix with an accuracy of 1 per cent produced a tough planning problem. Blowing speeds up to 7000 fpm would be required to move the core sand from the mixing station to the coreblowing plant. Ten basic mixes had to be produced, allowing for changes required by variations of mix components.

Four Automatic Units—Installation of four automatic units for preparing the core sand proved to be the solution to the problem. Now, batch weighing equipment, programmed and controlled by punched cards, measures the sands and additives. Each unit includes one scale for weighing sand while another weighs the dry additives. Two types of sand and three dry additives are conveyed by belt conveyors and stored in two-compartment hoppers above the scales. Three time-cycle controlled metering devices, also controlled by the punched cards, are used to dispense liquids to each unit.

Mullers are used for mixing, and the bonded sand is carried to its destination by a pneumatic system. Formula selection for the ten mixes is controlled by a punched card system; variations in a mix are set up by changing the pattern of punched holes on the proper card. Besides a control panel for the punched card system, there is a panel for mixing control and another for governing the routing of the mix.

Card Starts Cycle — The operational cycle begins when a punched card is inserted in the drawer of

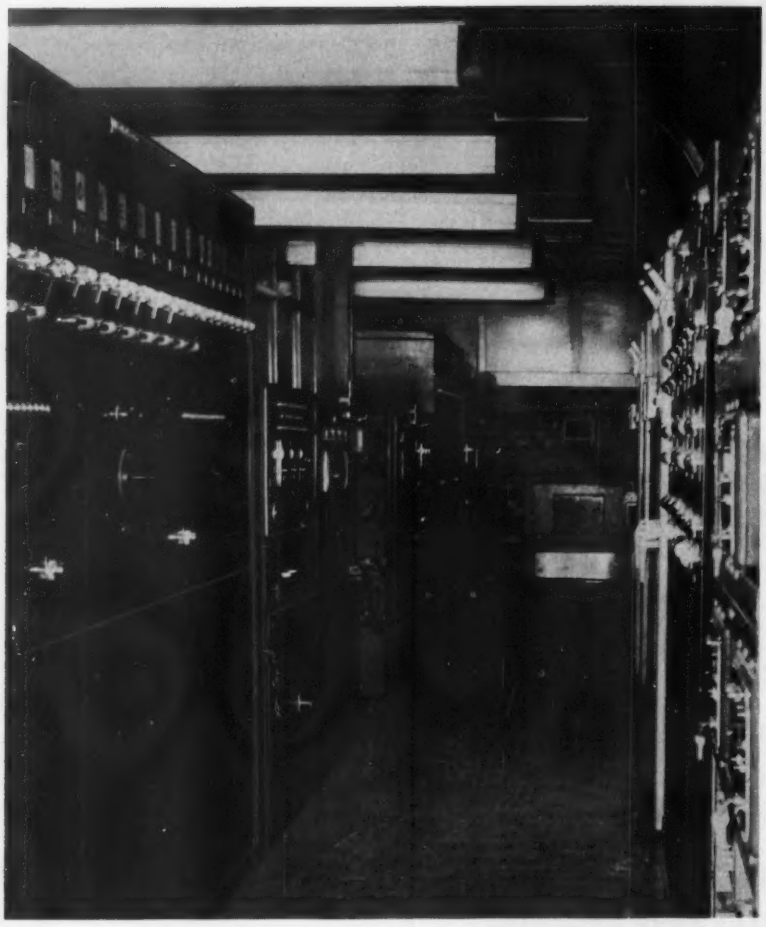


Fig. 2—View of control room. First panel on the left is for routing control, the second is for proportioning control, and the third is for mixing control

the proportioning control cabinet (Fig. 3). Monitor lamps, one in the upper row bearing a letter and a numbered group in the middle row, are illuminated to indicate the selected mix and to show the individual ingredients of the mix. Progress of the weighing sequence is indicated by the numbered lights; each of these lights goes out when its corresponding ingredient has been weighed. On pressing the start button, a red light illuminates, indicating that the weighing sequence has commenced.

The punched card passes under electro-sensitive feelers, which transmit impulses to preselector units fitted in the scale dial heads and the liquid meter pump revolution counters. These units preset the required quantity of the first ingredient in the dry and liquid groups. The cycle is timed so that weighing of the bulk dry materials and the dry additives starts simultaneously. Delivery of the metered liquid constituents to the mix muller is delayed until after the dry mix has commenced.

The weighing cycle proceeds as the vibratory feeder (Fig. 4) for bulk materials is started by an impulse from the controller and commences high-speed delivery of the first ingredient—normally Aylesford sand—to the weigh hopper. As the weight approaches the preset value, a detector actuated by the scale pointer operates relays which change over from fast to slow speed on the vibratory feeder. As a result, delivery is reduced to a trickle. At the instant when the correct weight has been delivered, another relay breaks the power supply to the feeder and extinguishes the appropriate "weigh in progress" lamp on the control panel.

A signal from the controller totals the weight of the first and second ingredients (the latter is Garside sand) and presets the required total weight at the scale dial head. Sand from the Garside container then is vibrated to the sand weigh hopper and controlled to the finish point as before.

Additives Weighed — Additive materials such as flour, bentonite, and, in some cases, iron oxide are being weighed simultaneously with the above operations. If, at this point, the sand weighing cycle is complete, the bond weigh hopper discharges its contents into the sand weigh hopper. The red "in progress" lamp is now extinguished and the green "held" lamp illuminated.

During the weighing cycle the metering pumps transfer a preset volume of water and two oils from the storage tanks to the two blow tanks. When the start button on the mixer control panel is pressed, the dry materials are discharged into the muller and the mixing cycle commences. After a period of ten seconds the blow tanks discharge the liquid additives, under air pressure, into the muller. The green "held" light goes out and a new weighing cycle can be started.

The mixing sequence is timed and monitored by the mix timer. Orange lights on the mixer panel are illuminated in succession to indicate completion of adding dry materials, oil, and water to the mixer. The mixing cycle between each addition is timed on the appropriate timer. When the mixing is complete the mix is discharged automatically to the turbo-drive system. Delivery is indicated by a fourth orange lamp and timed by a fourth timer.

Triple Play — At this stage the conditions in the plant are that a finished mix is held in the turbo-drive awaiting delivery, another batch is being mixed, and a fresh batch is being proportioned. The operator's attention must now be diverted to the delivery control where the supply requirements of all core-blowing machines are indicated by illuminated lamps. Number of the light in the top row indicates the core machine needing material, and the letter indicates the mix required. The lights are actuated by bin level relays in the coreblower storage hoppers which

Fig. 3—Punched card is placed in the proportioning control unit. Pattern of holes in the card governs amounts of ingredients included in each mix

operate when the sand in a hopper drops beneath a given level. Memory lights in the bottom row are lettered to show the mix held in the turbo-drive.

A mix is supplied to the appropriate coreblower by selection of the machine number on the 14-way switch on the panel. Selection of the number illuminates the equivalent "selected station" lamp in the middle row. Pressure of the start button will now deliver the charge to the coreblowing machine and the next mix can be completed.

Provision is made for the weighing, mixing, and delivery operations to be carried out manually in the case of failure or malfunctioning of the automatic system.

On the proportioning control panel, a switch enables the weighing sequences to be selected and operated manually. Controls on the mix control panel permit the mixing sequences similarly to be controlled.

Uniformity Maintained — The system described eliminates manual labor in the handling of the raw materials, and reduces to a minimum the labor required in the coremaking shop. In addition, the plant operators take no part in proportioning the mix, with the result that homogeneity is insured in each individual mix and uniformity is maintained throughout the longest production run.

Acknowledgment is due for data and illustrations to the Ford Motor Co., Dagenham; to the Sinex Engineering Co. Ltd., Feltham, the designers of the plant in collaboration with Ford engineers and suppliers of the weighing and mixing equipment; and to Oerlikon Machine Tool Works Buehrle & Co., Zurich-Oerlikon, Switzerland, the designers and manufacturers of the program control system used.

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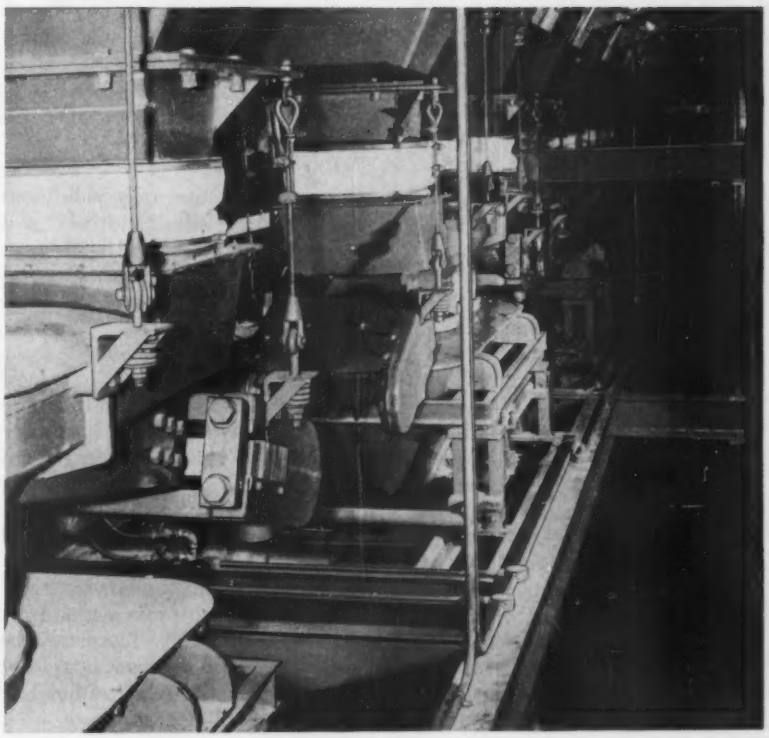


Fig. 4—Vibratory feeders move sand, flour, iron oxide, and bentonite from hoppers to proportioning units. Two feeders are used with each unit

Foundry Technology ...

Where Is It Headed?

FOUNDRY queried industrial research people and educators to get their thoughts on current and future developments in foundry technology and education. Twenty-two authorities participated in the study. Their viewpoints are expressed in the article presented on the next ten pages. You may find it thought-provoking

● "APATHY is the only deterrent to progress in the foundry industry," says one of the 22 industrialists and educators who responded to FOUNDRY's question: "What are the research and educational trends in the foundry industry?"

That comment typifies the thoughts of those who contributed to this "brainstorming session on paper." Foundrymen in general, it is said, are reluctant to accept new ideas, to use them in production, and to generate a philosophy of progress and agressiveness. In these things they have common human failings.

But the foundry industry has not stood still. Contributors acknowledged the technological progress achieved in recent years. They also expressed optimism over indications that current research trends will accelerate developments in the near future. Naturally, no universal agreement exists on exactly how this progress will take place.

Plain Hard Work—Some people, the conservatives, feel that most progress will result from plain hard work in applying current knowledge to foundry practice. "In my opinion, the potential for improvement from within, using existing materials and methods, is far greater and also closer to the thinking foundryman's grasp than the far-off, greener pastures. If this reformation from within occurs, it will place the foundryman in a much stronger position to evaluate and employ new developments."

The opinion was expressed that, "ten years from now iron, aluminum, and copper-base alloys still will be the important cast materials. Whether producers of castings from those alloys will enlarge or lose their share of the gross national product will depend on the people in the industry and the properties of castings produced.

"Technically trained people will have to dominate foundry supervisory positions. Reproducibility of casting properties will have to attain a level at least as high as that attainable in the finest wrought steel bar stock. If a designer is to employ the full potential of the casting process he must know that a minimum level of properties will be met in a casting at locations which are

Authorities View Research and Educational Trends . . .

highly stressed during service."

Change Is Certain — A larger number of those who submitted comments — those with a bit of blue sky in their eyes—say that the foundryman should realize that change is the only certain thing. "To wait until everything is 'for sure' before making a change is not necessarily the way to make a profit."

"It would seem that a broad, imaginative approach to the problem of metal placement could yield enormous dividends in extending the applications of castings." This man emphasizes the ability of the casting process to put metal where it is wanted. He says this "shape control" has been the industry's advertising approach for years, but

- Foundries of the future will be grouped by quality of product rather than by base metal or molding method.
- For some time, the tide of education (at the college level) has been moving away from the practical, or 'how,' side, to the theoretical, or 'why,' side. It appears that this trend will continue.
- Why can't we aim for a major gain in casting technology in terms of economy and quality through development of closed system molding and transfer of molten metal to a suitable mold?
- Failure to appreciate the separate and equally important functions of gating and risering systems accounts for much scrap. People who pour down risers or use downgates for feeding are not interested in making top-quality castings.
- Much fundamental work on fluid flow still remains to be done, and then the knowledge will have to be extrapolated to practical engineering ends. There is a big gap between what we know needs to be done and knowing the best practical ways to do it.
- Vacuum and/or inert atmospheres will be used if reactive metals are cast and must be used for high-integrity, highly alloyed steel castings.
- The improvement of molding media is one of the most active and fruitful fields for research and development work.
- Use of the diecasting process will continue to expand.
- The use of furfuryl alcohol and phenolic resin binders probably will expand because of their ability to produce cores with close dimensional tolerances.
- Wider applications are anticipated for plastic patterns, but improvements in plastic materials and their use will be required.
- Practical knowledge of heat transfer and solidification must be enhanced by an understanding of fundamentals.
- Superalloys of the future may be based on intermetallic compounds.
- Heat treatment of castings will be accomplished in seconds with the use of radiant heating, induction heating, and salt bath methods.
- There is no such thing as a quality casting that is 'good enough' even though it obviously contains potentially serious flaws. We will have to develop greater pride in our product.
- I believe the pressure for improved casting quality will make necessary the purchase of new equipment and better instrumentation to obtain the better quality and control required.
- Inspection can not be accepted as an ultimate quality control function. It must be tolerated only for the time required to determine causes of deficiencies, eliminate those, and upgrade the process and the product.
- Increasingly, cast shapes will be subjected to subsequent treatments such as forging, rolling, impact or explosive forming, coining, and extruding.

Apathy is the only deterrent to progress in the foundry industry

actually that ability is limited by draft requirements, metal fluidity, hot tearing, and other problems.

He suggests development of a mold material with minimum chilling characteristics. That might indicate an aggregate with insulating properties, a water-free mold system, a nonwettable material, or a very refractory material which would permit higher metal pouring temperatures.

He would like to see development of metals with greater fluidity or improvement of apparent fluidity with mold coatings or pressure mold filling. Patterns and molds must be improved substantially to produce castings with thinner sections and narrow dimensional tolerances.

Another contributor sees the equipment requirements of the nuclear and space-technology age as a challenge to the foundry industry. Several laboratories are working to develop materials which do not now exist in practical form. "If one considers the requirements of strength, heat resistance, hardness, and density which these materials must meet, it is apparent that many of them will be almost completely unmachinable by normal methods.

"Casting may be the only feasible method of converting these materials into desired forms, but the requirements of accuracy, thinness of sections, complexity of shape, and what are likely to be rather exotic properties, will present tremendous challenges to the casting industry."

Foundries of the Future—A feeling exists that the present trend in consumer buying toward products with functional quality will continue. This, plus local and foreign economic competition, will force foundries to be grouped by quality of product rather than by base metal or molding method.

In general, foundries will be grouped into three classes: 1. Small shops producing short runs of castings with no critical mechanical qualifications. 2. High-production foundries with increasing requirements for mechanical performance of product. 3. Foundries producing custom engineered castings.

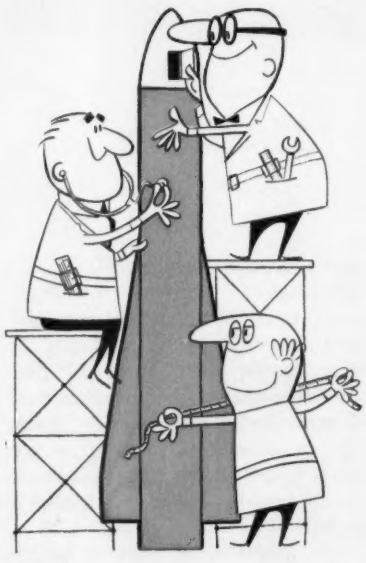
Class 1 foundries will have insufficient automatic equipment to compete for the high-production jobs and insufficient technical staff and process control to bid on castings which must have the ultimate in performance and reliability. Increased application of the current level of technology in the areas of gating, risering, and molding techniques will be required by these foundries to reduce scrap sufficiently to assure a reasonable profit.

Class 2 foundries are the large, mechanized shops which will achieve a high degree of automation by present standards. They will face increasing foreign competition and their future will depend more on the use of mechanical and electrical engineers than on metallurgists.

Class 3 foundries are the engineer's challenge. They will provide castings with rigid specifications as to shape and performance. Equipment for these foundries will not be centered around mass production capabilities, but rather on the degree of process control desired.

A separate engineering department will be required for this group of foundries. It should be able to support itself by functioning essentially as a consulting-research organization of experts who will collaborate directly with parts designers.

After the design phase of cast parts development is completed, the experts will detail specifically all metallurgical control and process



Equipment requirements of the nuclear and space-technology age in which we have embarked present a stiff challenge to the foundry industry

control required in the foundry with the aim of "making it right the first time." In some instances the company foundry may not have the required process or control equipment, and another casting firm will be asked to produce the castings.

Some present research groups attempt to operate in this manner but they are handicapped by the inadequate level of present technology and by time-consuming research which must be conducted for each casting job before the pattern is ready for production.

A substantial increase in emphasis on and expenditure for research is required if the Class 3 type of foundry operation is ever to get off the ground.

After the design phase of cast parts development is completed, the experts will detail specifically metallurgical and process control required with the aim of "making it right the first time"

Education of Foundry Engineers

Education proved to be among the most controversial subjects discussed by participants in this study. The point of controversy is the trend toward science education at the undergraduate college level and away from the development of technological skills for practical application in foundries. Those commenting on education generally agreed that engineers are and will be receiving more instruction in basic sciences and in engineering sciences such as heat transfer, fluid flow mathematics, and material science.

Colleges Stress Theory — "For some time, the tide of education (at the college level) has been moving away from the practical, or 'how,' side, to the theoretical, or 'why,' side. It appears that this trend will continue. The result has been to interweave cast metals education with current metallurgical curricula. The trend toward fundamentals also has been occuring in other engineering courses, with the result that foundry shop courses generally have been removed from other engineering curricula.

"Recent educational trends have been characterized by closer co-operation on a faculty and teaching level between the metallurgist, chemist, physicist, and the mechanical, chemical, civil, and electrical engineer. This has resulted in courses in materials engineering and in a generally wider scope of education, or breadth at the expense of some depth.

"Perhaps this trend increases the foundry student's interest in other fields or more general applicability, and will, if properly followed, increase his understanding of many basic principles in the foundry area. But the room for specialization (in the foundry or any other metallurgical process) in undergraduate education becomes smaller.

"Specialization in foundry and other processes is being done by graduate students. The graduate field with its research activities is wide open for expansion, and many college administrations are encouraging this trend."

It is the feeling among those who subscribe to the new educational trend that students from the undergraduate programs are better all-around potential engineers and, after a familiarization period in industry, will be of great help to that industry. These students have been provided the background necessary for our rapidly changing industry outlook.

If engineers with specialized training who can be helpful in foundries are required, graduate students are better qualified. They have the general background plus the special training.

Need Practical Education—The other side of the picture was stated this way: "I am concerned with the current trend in university engineering education toward the pure science approach to training, eliminating technological and laboratory experience. In the final analysis, industry requires engineers who will contribute to the profit-making motive, engineers who will engage in activities for which their aptitudes and training make success and achievement possible."

"Too many gaps exist in our metallurgical, gating, and heat transfer knowledge at an engineering level for us to be satisfied with the current educational trend toward essentially pure science training for engineers. Industry will suffer if the conventional engineer is forced into becoming a scientist with no 'feel' for practical application of basic information."

There is some concern, too, that

the trend to basic science education will make the obtaining of engineering talent difficult for smaller foundries. And, if science-trained engineers are hired, the foundries may not have facilities to train them for profitable and satisfying employment.

Another view is that most trained foundry personnel are metallurgists who have only secondary interest in molding materials. Knowledge of ceramics is necessary, it is said, if progress is to be made in molding technology. In recent years foundries have attempted to hire ceramists without much success because ceramic graduates have little acquaintance with foundry work. The suggestion was made that this problem might be solved by a foundry-ceramics course offered in the last year of study at metallurgical and ceramics schools.

The co-operative college system which offers students alternate periods of study and work was mentioned as an excellent way for students to learn the problems of industry concurrently with their studies either in pure science or practical applications courses.

Melting and Metal Handling

"Why can't we aim for a major gain in casting technology in terms of economy and quality through development of closed system melting and transfer of molten metal to a suitable mold? Continually rising standards of casting quality demand cleaner and more uniform metal structure in the final cast product. Complex and inefficient pouring and gating systems, standard in the industry for centuries, need to be scrutinized and changed to give a more favorable casting yield."

Contributors point out that some progress has been made in alloy melting and handling in the following fields:

1. Inert gas and vacuum arc melting and casting processes developed originally for metals such as titanium and zirconium.

2. Hot metal transfer by siphoning as now used in the aluminum industry.

3. Closed system mechanical pumping and pipe line transfer used in the magnesium industry for supplying molten metal to ingot molds, direct chill ingot casting, and automatic die casting.

4. Low-pressure permanent mold casting processes used by European and American foundries with resulting high casting yield and great potential for automation and closed system handling.

With interest increasing in alloys for high-temperature applications, high-heat sources will have to be developed to melt those alloys. One contributor suggested that solar furnaces are a likely choice. Furnaces with parabolic mirrors up to 60 in. in diam have been reported in the literature. They are said to attain about 6400° F, but the effective melting area is only about 0.3 in. in diam. However, a number of furnaces might be combined to focus their beams on a larger area to increase their practicability.

A substantial increase in emphasis on and expenditure for foundry research is required

A number of contributors, keeping their feet closer to the ground, anticipate increased use of electric induction furnaces for melting ferrous and nonferrous metals. One contributor commented, "The problem and cost of controlling dust and smoke emitted from a cupola makes worthwhile the consideration of electric furnace melting of iron."

Mold Filling—"As yet, foundrymen have no real appreciation of the basic importance of fluid flow and design of pouring systems. In spite of a relatively fair amount of investigation into fluid flow, little practical use has been made of the information to date. Perhaps pressurized gating, streamlined flow, filter screens, and prefabricated runner systems are really all that currently is used to any extent. Failure to appreciate the separate and equally important functions of gating and risering systems accounts for much scrap. People who pour down risers or use downgates for feeding are not interested in making top-quality castings.

"Not only is there hesitancy in accepting new methods of mold filling, but reluctance to re-rig patterns and to spend some extra money to do the job right is a real deterrent to improvement."

Another contributor describes as "striking" the recent developments in hydrostatic pressure gating systems in green sand molds for ferrous metals. Future developments, he believes, will bring the forcing of metal by inert gas into a bottom opening in the mold without exposing the metal to the atmosphere. The metal will be vacuum treated to remove gases and will be delivered to the mold in a ladle encircled by an electric induction coil to maintain metal at optimum temperature until all of it has been used.

The use of closed-system molten metal supply to dies and permanent molds is fairly well established in light metal shops. Development of a closed system (melting, delivery, mold filling) applicable to sand mold foundry usage may be more difficult. "A lot of ingenuity and initiative will be required here, but, unless it is accomplished, we may expect to see an even greater trend away from the use of sand castings in the future."

General agreement exists among those who commented on the various aspects of mold filling. Their ideas are expressed aptly by this quotation: "Much fundamental work on fluid flow still remains to be done, and then the knowledge will have to be extrapolated to practical engineering ends. There is a big gap between what we know

needs to be done and knowing the best practical ways to do it."

Vacuum and Inert Atmospheres

Those commenting on the use of vacuum and/or inert atmospheres stand on either side of the fence but not on it.

"Foundrymen have many less exotic tools they must learn to use before attempting these more glamorous expedients. If foundries would only 'farm as well as we know how now' casting sales would double on the basis of quality and dependability alone. Vacuum melting and/or degassing and inert atmosphere pouring are fine for ingots but present formidable technical and economic problems in adapting them to castings manufacture."

"Vacuum and/or inert atmospheres will be used if reactive metals are cast and must be used for high-integrity, highly alloyed steel castings. The use of these techniques permits melting and casting metals with superior mechanical and metallurgical characteristics. These techniques must be applied to the common materials, and more foundries must develop abilities in their use."

Contributors pointed out that much remains to be learned about gas control as it is related to our more normal melting problems. Better tools now are available to measure gas levels and to aid experimental work with methods of controlling gas contamination. Hot tearing, the occurrence of carbides, and other problems can be studied more intelligently in the light of these new techniques.

"European foundrymen already are ahead of us in this field. They have developed better measuring instruments, but as yet have not progressed sufficiently in developing the relationship that may exist between the phenomena measured and the physical metallurgy of the resultant alloy."

In commenting on vacuum degassing of gray iron, one man pointed out that because of its high carbon content, iron at about 2800° F reacts very rapidly with practically any refractory material used for crucibles in vacuum degassing equipment. The reaction affects the iron structure adversely, making other correction measures necessary.

He suggests that molten iron be handled more carefully to avoid unnecessary splashing and exposure to air. Perhaps improved forehearth design will reduce the splashing that now occurs.

One commentator described as "exciting" the use of a cold-crucible induction furnace for melting under vacuum or inert atmosphere. The use of a metallic crucible induction furnace is said to be less complex than the use of inert arc, consumable-electrode, skull-melting, or electron-beam furnaces. Vacuum and inert atmospheres may be used alternatively as desired during the melting cycle, and no possibility exists for contamination of the charge from a ceramic crucible.

Educational trends indicate closer co-operation on a faculty and a teaching level between the metallurgist, chemist, physicist, and the mechanical, chemical, civil, and electrical engineer

Molding Media

This man's words express the general feeling among those who commented on trends in mold making: "The improvement of molding media is one of the most active and fruitful fields for research and development work. Unfortunately, a very real shortage exists of qualified men with adequate ceramic background for effective basic work in this area."

Sizing, blending, and preparation of purer refractories are needed: "Even our most carefully prepared investment refractories leave much to be desired in over-all performance."

Some ceramic materials suggested as possible molding aggregates are magnesia, thoria, beryllium oxide, carbon, and graphite. Nonwettability was mentioned frequently as a desirable characteristic of mold aggregates.

The need for inorganic binders that produce little or no gas at the mold-metal interface was mentioned often. These binders should be required only in small quantities and should cure quickly at room temperature or at temperatures no higher than those attained in conventional core ovens. The aggregates and binders should combine to make a refractory mold that is gas free and dimensionally stable.

"Probably several ceramic compositions could be used in different sections of the mold to take full advantage of differences in the physical properties exhibited by ceramic materials. By controlled solidification, the present risering techniques will become obsolete. Such developments will permit the full realization of engineered mold-

Students from the undergraduate programs in science are better all-around potential engineers

ing techniques."

One researcher reported working with molds having sections of metal, sand, and plaster. Plaster is used in the risers. This is part of a project to develop aluminum castings of higher strength, better surface finish, and generally improved quality. The different materials in sections of the mold conduct heat at different rates and, therefore, provide a control of solidification.

It was stated that since the cooling effect on molten metal of any material is largely a function of the material density, as well as its base composition, there seems to be an unlimited future for work on materials which effectively will control or modify solidification.

The chemical and physical nature of mold-metal interface behavior is a rich field for study. Some work is being done on the mold wetting behavior phase of this field. This has developed some data on the problems of penetration and veining.

Mold Ramming—A number of contributors commented on molding methods. It was pointed out that use of high-energy molding methods involving pressures may give way to other methods for compacting materials as new aggregates and binders are developed. "Pressure packing of aggregates works only when excess binder is present to aid movement." Researchers are working on ways to reduce interparticle binder, not to increase it.

Vibration was suggested as a method of compacting mold materials. Its use, however, awaits development of binders which can accommodate consolidation by vibration only. One man foresees that mold blowing will develop from a flask filling method to a compacting process.

Need Mold Accuracy—Conventional green sand and current molding equipment got a pat on the back. "Improvement of molding materials and equipment, coupled with automatic controls and automation of process, have resulted in better surface quality and dimensional integrity of ferrous and nonferrous castings. More improvement is needed, using present or new materials, to produce dimensional control at the level advertised for current shell molding practice."

Another contributor stated that the recently developed concept of mold wall movement contributing to shrinkage defects points out clearly the desirability of rigid molds for iron castings. "When expansion due to graphitization of gray iron causes enlargement of the mold cavity, its beneficial effect is lost. Many gray and ductile iron castings can be made perfectly sound in rigid molds without risers for feeding. Dry sand, ceramic, and metal molds, if not allowed to expand, can aid in reducing this type of shrinkage."

Diecasting—Cast metal specialists will enter the diecasting field in increasing numbers. Known facts about metal behavior will be ap-

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plied to a much greater extent than in the past. Use of the diecasting process will continue to expand. Improvements foreseen for the process are better gating methods, better venting of dies, reduced porosity and better mechanical properties in diecastings, improved diecasting alloys, and improved design plus lower cost for dies. Dies with smooth surfaces and close dimensional tolerances will be cast to shape in ceramic molds.

Coremaking—"The use of furfuryl alcohol and phenolic resin binders probably will expand because of their ability to produce cores with close dimensional tolerances. This is an important factor in the current trend to reduce section size of castings. Also, customers are becoming more critical about location and cleanliness of cored passages in castings. More accurate cores and molds will reduce the occurrence of fins and other irregularities where cores and molds meet."

Patterns—Increasing demands for close tolerances in castings are making a higher degree of accuracy mandatory in patterns of all types. Also, all patterns must be identical to all others in production of a given cast part. Accuracy and uniformity are required of castings finished in automated machines and in the production of minimum wall thickness castings for which constant demands are being made.

Wider applications are anticipated for plastic patterns. Advantages are seen in cost savings and in reduced lead time for making patterns, particularly when multiple patterns are required. Plastic patterns may be duplicated with relative simplicity. "Substantial improvement in the usual plastic art and in the plastic materials will be required before the wider applications can be realized fully."

Plastics must have higher levels of mechanical properties, greater service life, and improved mold-pattern release properties. "A need exists for a plastic material which can withstand higher temperatures than current materials for making patterns or coreboxes in conjunction with heat-cured, organic bonded sand mixes."

Heat Transfer and Solidification

Solutions to practical problems such as internal soundness, hot-tearing, cracking, segregation, and grain size and structure will be found through studies in the fields of heat transfer and solidification, according to one researcher.

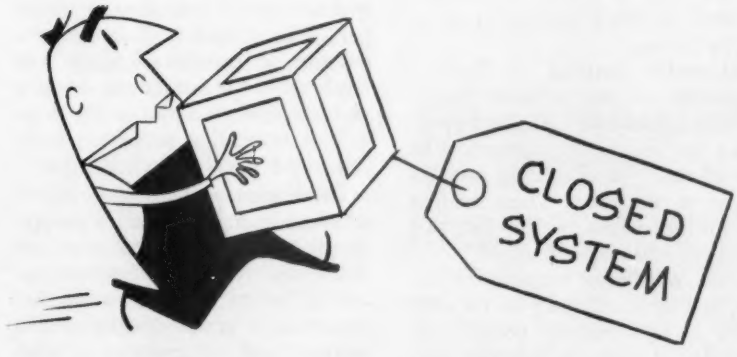
"Heat transfer and solidification are imposing titles, but, reduced to practical considerations, these terms encompass such well-known items as chilling, insulation of risers, padding, exothermic feeding, mold-metal interface behavior, and directional freezing to obtain soundness.

"Our practical knowledge of these matters must be enhanced by an understanding of fundamentals. This will develop the technological knowhow necessary for making the higher quality castings required for the engineering advances of the future. Studies in these areas are taking a practical turn, and increasingly useful results can be expected."

Another contributor points out that reasonably scientific approaches already can be taken to the problems of riser placement and riser dimensions. "If the time comes when the average foundryman is willing to apply the scientific knowledge already at hand, the systems-engineering approach to heat transfer and solidification utilizing computer tools will be feasible." The literature describes at least one application of a digital computer technique to a solidification problem in uranium ingots.

It was suggested that control of the solidification process can be assisted by development of a monolithic mold which can control the rate of heat extraction over a wide range. A refractory metal mold with expansion characteristics matched to the metal being poured, and with provision made for circulating liquid metals in the mold behind the mold cavity to control heat extraction, would provide tremendous flexibility in casting design.

In additional comments on solidification it was pointed out that use of inoculants has proved valuable with many metals, but optimum use of this technique is not always made. The effects of sonic and ultrasonic vibrations on solidification have been studied, and significant advances in this field can be expected.



Development of a closed metal system (melting, delivery, mold filling) applicable to light metals sand mold foundry usage is required if the trend away from castings produced in sand molds is to be slowed

Alloy Development

Considerable progress has been made in recent years in improving the properties of alloys. Metallurgical developments and process control plus the use of ceramic molds have made possible the production of low-alloy steel castings with ultimate tensile strengths above 300,000 psi. Castings of aluminum alloys 355 and 356 have been produced with 45,000 psi tensile strength, 32,000 psi yield strength, and 7 to 8 per cent elongation.

Current work on aluminum al-

The common practice of measuring large numbers of parameters as protection against their unknown or hypothesized effects contributes little to attainment and maintenance of optimum operating conditions

loys by one firm involves experiments on new ways of removing gas and inclusions from the alloys. The work involves fluxing with chlorine-nitrogen and other mixtures. It is said that chlorine can be diluted considerably without losing its characteristics.

In the gray iron field foundrymen, engineers, and researchers are making wider use of gray iron's engineering properties in new casting applications. Also, engineering data on that metal are being disseminated more widely than in the past. "Many misnomers and commonly accepted fallacies about gray iron will be dispelled."

"Research on gray iron in recent years has produced a number of improvements: Better high-temperature properties through proper melting techniques and mild alloying; sounder castings through new gating and risering techniques; development of heat treatments to provide wear-resistant casting surfaces, and improved melting techniques to achieve consistent physical properties in the metal.

"New developments should be along the following lines: Casting 1/16 to 1/8-in. sections with no chill or white iron; automatic feedback of chemical analysis results so that precise control of iron analysis can be commonplace, and melting techniques that permit quick formation of the type and size of graphite desired, including nodular graphite, in the furnace."

Bimetallic Castings — Castings comprised of two or more metals are being produced in limited quantities for certain applications. The use of this type of casting may increase in the future. These castings permit utilization of the desirable characteristics of each alloy.

One contributor suggests, for example, that a relatively brittle alloy with a high-melting point, high modulus of elasticity, and low coefficient of thermal expansion might be used in the center of a casting. The outside of the casting could be of metal of lower modulus of elasticity, higher coefficient of thermal expansion, and of lower melting point. Through proper heat treatment the casting surface could be put in compression, thereby improving load-carrying capabilities of the casting and especially improving the notch sensitivity and fatigue characteristics.

In another field, the work of solid-state physicists on intermetallic compounds is just beginning to uncover potentialities of this class of materials. "It is quite conceivable that superalloys of the future may be based on these compounds, and in those cases where the compounds are not readily worked, the casting process will be considered seriously as the preferred means for achieving the desired configuration."

Treatments of Alloys—One contributor states that combinations of heat and moderate working or elastic straining might be used to effect transformation or to intensify precipitation hardening. "Typical of this approach, already feasible commercially, is the ausforming process which involves deformation of steel at a moderately elevated temperature prior to martensitic transformation. Transformation of austenite to martensite in the conventional austenitic alloys can be achieved in many cases at subzero temperatures, and this can be accelerated by plastic deformation."

"In general, vibration will not achieve the plastic deformation necessary to facilitate or accelerate transformation or precipitation hardening. However, it is conceivable that high-energy waves passing through a casting could accomplish the desired plastic deformation without dimensional change in the part. This is spoken of at the present time as impulsive loading. The combination of impulsive loading and temperature variation could result in interesting and conceivably important metallurgical changes."

Other comments on the treatment of alloys to improve casting properties indicated the existence of evidence that vibration increases apparent fluidity of metal under conditions such as the feeding of thin sections, and accomplishes a measure of stress relief at fairly low heat treating temperatures.

"Heat treatment of castings will be accomplished in seconds with the use of radiant heating, induc-

tion heating, and salt bath methods."

Quality Control and Reliability

Acceptable levels of quality for castings are going up. Specification limits are getting narrower on dimensions, soundness, mechanical properties, hardness, machinability, and other characteristics. The aim is to get greater uniformity in castings. One of the reasons, as touched upon previously, is that more and more cast parts are being finished on automated machines. Castings must fit the jigs of these machines. Also they must be free of hard spots which can damage cutting tools and slow or stop production.

"There is no such thing as a quality casting that is 'good enough' even though it obviously contains potentially serious flaws. We will have to develop greater pride in our product and realize that one bad performance on the part of a casting may lose thousands of dollars worth of new business."

References were made in the comments to quality improvement through more rigorous inspection methods, possibly based on ultrasonics, magnetic, and electrical-resistance techniques. Expanded use of statistical methods, the use of data-processing machines for determining specifications limits, and the application of computers in the systems-engineering approach to foundry problems are foreseen.

It was pointed out that past and current research has developed methods, materials, and controls which eliminate major causes of nonuniformity and permit quality casting production. "Management must insist on, and provide tools for, high-quality production."

"I believe the pressure for improved casting quality will make necessary the purchase of new equipment and better instrumentation to obtain the better quality and control required."

The following comment, perhaps, defines the goal of ultimate casting quality:

"The function of quality control is to provide the means of determining scientifically the optimum operating conditions and to avoid the groping practices of trial and error.

"The common practice of measuring large numbers of operating parameters as a precaution or protection against their unknown or hypothesized effects contributes little to attainment and maintenance of optimum operating conditions. It is not good business to spend money on measuring everything measurable.

"Inspection can not be accepted as an ultimate quality control function. It must be tolerated only for the time required to determine causes of deficiencies, eliminate those, and upgrade the process and the product."

In other words, "make it right the first time."

When the average foundryman becomes willing to apply the scientific knowledge already at hand, the systems-engineering approach to heat transfer and solidification, using computer tools, will be feasible

Design, Cleaning, and Forming

Several contributors agreed that the field of casting design needs considerable development. "Much has been said and written about this subject but the type of information needed to encourage designers to use castings is not readily available. Jobbing foundries in general seldom were called upon to design a part but were asked merely to make castings from patterns submitted to them or, in some cases, to make patterns from drawings they received from the manufacturer."

This man goes on to say that if any defined areas of knowledge in casting design exist, they are located in various manufacturing plants and not in the foundry industry. "Certain features of the foundry process have not been exploited or promoted as much as they should be. The foundry industry should underwrite a program that will provide data to design engineers."

Another man says, "Too often the design of a casting is based on an assembly of flat plates or simple curves joined by fillets. Designers seem to be tied to the products of the rolling mill and the forging shop. Our schools do not teach how to make maximum use of the foundry process."

In the field of forming, the suggestion was made that the advantages of the casting and wrought processes can be combined by subjecting cast shapes to subsequent treatment by forging, rolling, impact or explosive forming, coining, and extruding. Some work has been done in this field of post-casting treatment, and an increasing amount is anticipated in the future.

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AUTOMATIC POURING

of Aluminum Sand Castings

Automatic pouring and a novel melting arrangement are features of an aluminum sand casting line, converted from gray iron, at Pontiac Motor Division, General Motors Corp. Hot-box cores are used

By JACK C. MISKE
Associate Editor

● AUTOMATIC POURING and some startling innovations in melting practice are features of an aluminum sand casting line established this year at Pontiac Motor Div., General Motors Corp., Pontiac, Mich., to produce timing chain covers for 1961 models.

Except for the melting and pouring facilities, the line is the same which formerly was used to produce gray iron timing chain covers. When it was decided that the division's 1961 cars would use aluminum covers, foundry management personnel asked for permission to convert a portion of its gray iron facilities to sand casting of aluminum. A program subsequently was presented to divisional management, and the new line is the result of its signal to go ahead.

Essentially, the line consists of a loop, almost half of which is in the basement—from a point about 25 ft beyond the pouring station to where the mold conveyor emerges at the shakeout.

Sand Preparation—Conversion of the line from gray iron to aluminum casting production involved no changes in sand or its preparation except that seacoal no longer is added to the mix. The system contained about 800 tons of sand when the changeover was made, and the same sand has been cycling since then. Sand properties are checked constantly and are kept within rigidly controlled limits in all respects.

Sand falls from the shakeout through the grate onto a conveyor which moves it the length of the line to the muller. After mulling, it is elevated to temper bins from which it feeds to a conveyor, over the molding machines, which automatically refills hoppers as sand is required. Probes on the hoppers measure the level inside and actuate plows to divert sand as the level drops.

Molding Machines — Molds are made on two units, the first of which produces drags and the second copes. Both machines are operated automatically. An operator at each initiates the molding cycle at a console where he merely pushes a button. Flask size is 32 x 48 in., and three castings are made in each mold.

Flasks enter from the shakeout, are filled with sand automatically from the overhead hoppers, and are jolted and squeezed successively. The two units operate identically except that the drag molds are rolled over as they come off the pattern plate on that machine.

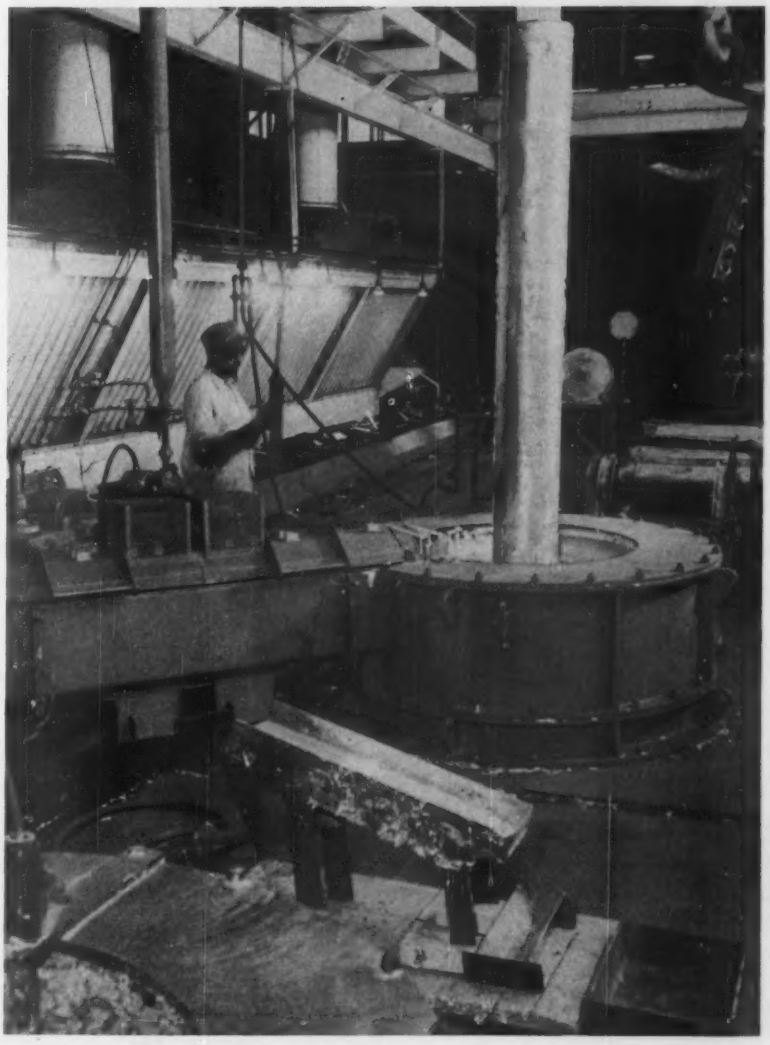
Drag molds emerge onto a conveyor, move forward a few feet, and automatically are placed on a power conveyor. As they move toward the cope machine, four cores are set manually in each of the three cavities in the mold.

At the cope machine, the cope half of the mold also emerges onto a conveyor and is moved forward a few feet. It then is engaged by a clamping fixture which lifts it over the drag and closes the mold. The completed mold moves from the closing station to the conveyor and goes to the automatic pouring station, which is part of the melting area.

Hot-Box Cores—Cores for the timing chain cover molds are made by the hot-box method, which is similar to the shell core process except that the cores ordinarily must be made solid because the set is extremely fast. Advantages of the process include relatively low binder cost, high-speed production, and excellent collapsibility. The last point is particularly important because ease of collapsibility can be varied by simple changes in the amount of binder used. In addition, the low pouring temperature of aluminum makes it doubly essential that cores

Automatic pouring is a feature of Pontiac's aluminum sand casting line. As a mold moves into position before the spout, it trips limit switches, and air pressure is applied to the surface of the metal in the pouring unit, ejecting a measured quantity of aluminum

Logs of primary aluminum 356 alloy are lifted, through an eye at one end, by a hoist and lowered into an induction furnace where they are melted as required

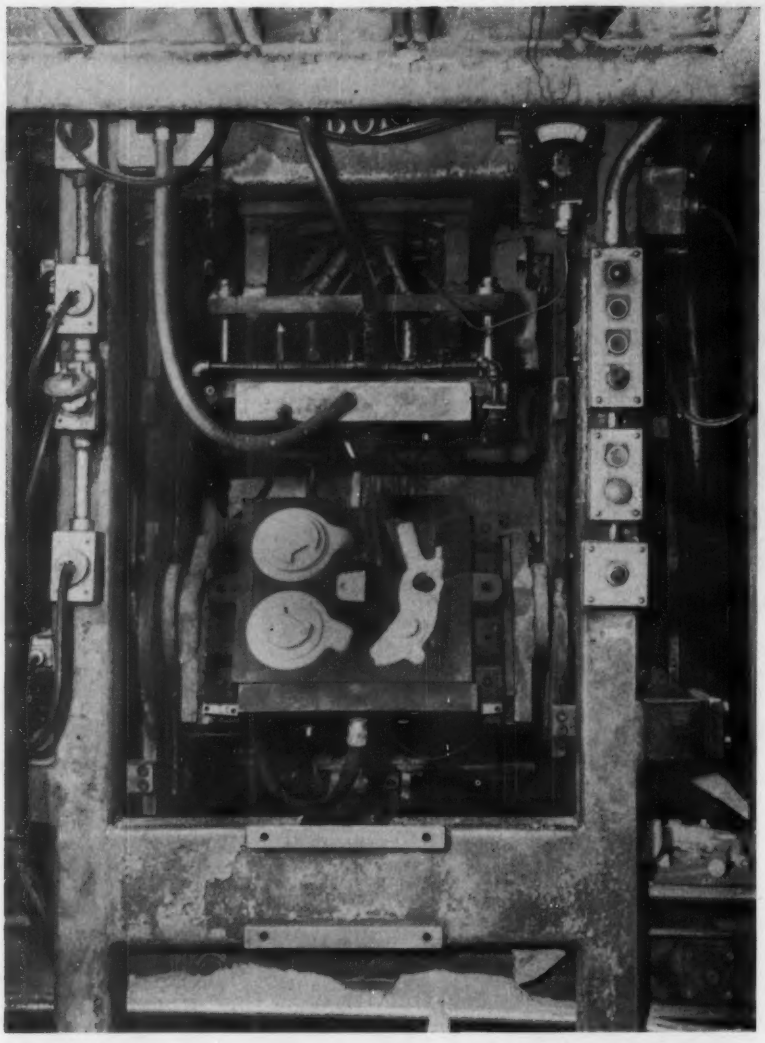


collapse easily so that their removal is not a problem.

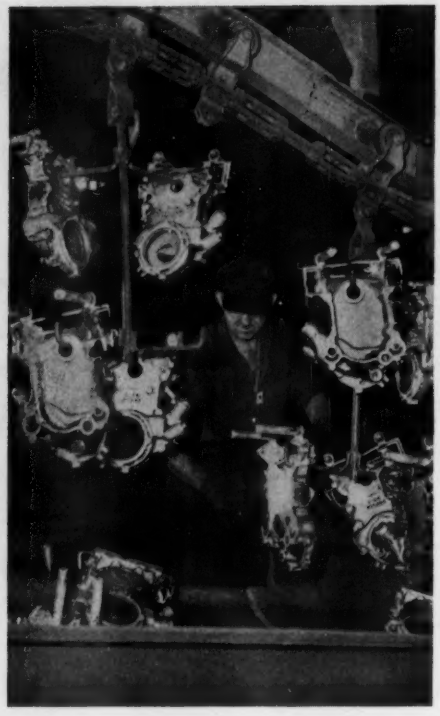
Pontiac currently is producing hot-box cores on two automatic machines. One is a four-station unit which makes cores for the intake manifold—a gray iron casting. The other is a one-station machine on which four cores for the timing chain covers are produced in a four-cavity corebox. This unit operates on a 15-second cycle, and the cores are ready for use as they emerge from the machine. The cores are placed on dolly-mounted racks which are moved from the core-making area to the molding line as required.

Melting—A new departure in aluminum foundry melting practice has made it possible for the Pontiac foundry to convert the former gray iron molding line to aluminum with no more change than the addition of melting facilities in a few hundred square feet of area adjacent to the line, just past the cope molding unit.

These facilities can produce from 4 to 5 tons of aluminum per hour on a continuous basis, and this amount of aluminum can be melted and poured by only one man. The high-quality metal this installation provides is a key factor in the suc-



Cores for timing chain cover molds are made by the hot-box method. All four cores are made simultaneously in this machine, which operates on a 15-second cycle. Cores are ready for use as they emerge from machine



Timing chain cover castings emerge from shakeout on an inclined conveyor and are placed on an overhead conveyor system

cess of the entire aluminum project.

Primary aluminum alloy 356 is purchased in the form of 1000-lb logs 8 ft long and 12 in. in diam, with an eye cast in one cast. Logs are brought into the melting area and stored on a large roller conveyor which they move across, as required, to a tilting fixture at the end nearest the furnaces.

When a new log is needed, the one on the fixture—which tilts to the vertical on a central pivot—is engaged by an overhead hoist and raised over the nearer furnace. It then is lowered into the furnace at a rate of descent which is a function of the metal needed at the pouring spout. While on the fixture, logs are preheated by gas flames to drive off any moisture.

The farther furnace is used for remelt of all kinds, including gates and sprues, saw filings, and scrap castings. Both furnaces are low-frequency induction units, sunk in the floor, down into the basement, so that only a couple of feet remain above floor level. Vacuum tests are made at regular intervals, and degassing with hexachlorethane tablets is performed if necessary.

From each furnace, an enclosed trough or launder draws off metal and transfers it to a holding furnace situated midway between the two melting units and immediately in front of the mold conveyor. This furnace is completely enclosed. Metal is drawn off well below the surface of the metal in each melting furnace so that no dross is included, and the two streams merge without turbulence in the holding unit. Consequently metal never is exposed to the atmosphere except during the actual pouring operation.

Pouring temperature is 1350° F, and metal is held at ±5 degrees by immersion thermocouples in the furnaces. Standby controls also are ready for use immediately if a thermocouple should fail.

Automatic Pouring—Molds are poured automatically from the holding furnace. A pouring spout protrudes fom the far side of the furnace and extends over the mold conveyor. As a mold moves into position before the spout, it trips limit switches at the back of the conveyor which initiate the automatic pour.

Air pressure within the sealed holding furnace does the job. Applied for a controlled time, it presses on the surface of the molten metal and ejects the proper amount from

the pouring spout—which is designed to operate something like a teapot ladle—and into a troughlike pouring basin on top of the mold.

As the poured mold moves down the line a few feet, it is sprayed with water to cool the metal in the basin rapidly, and that metal is picked off the mold by a man at the end of the line before the mold conveyor dips into the basement on its way to the shakeout.

Yield on these castings is unusually high and has run to as much as more than 80 per cent of the metal poured.

Shakeout—In the basement, the mold conveyor travels the full length of the line and emerges at the opposite end, where molds are shaken out automatically and cope and drag flasks are routed back to their respective molding machines.

Castings come out of the shakeout on an inclined conveyor from which they are picked off, inspected visually, and hung on an overhead conveyor system which transports them to the finishing area. First stop is at a high pressure washing unit which removes all sand and cores. The castings then are taken from the conveyor, placed in a fixture, and passed through an automatic sawing operation where gates and sprues are removed. As they leave this unit, they are placed on a belt conveyor, and flash and any other excess metal are knocked off manually. Castings are aged at 425° F for four hours in a former core oven.

More To Come—Currently, the timing chain cover casting is the only aluminum sand casting produced at the foundry, but it is expected that others will be added if decisions are made to convert any more gray iron castings to aluminum.

Other aluminum sand castings already have been produced on an experimental basis, including blocks and cylinder heads. Foundry personnel at Pontiac are confident that they can make such parts on a volume basis. The experimental castings were poured in molds made for gray iron, but it is believed that redesign to take full advantage of aluminum's properties would make possible the sand casting of lightweight, close-tolerance castings of high quality. In addition, they could be produced at rates up to 200 molds per hour per set of pattern plates by the conversion of existing gray iron sand casting facilities.

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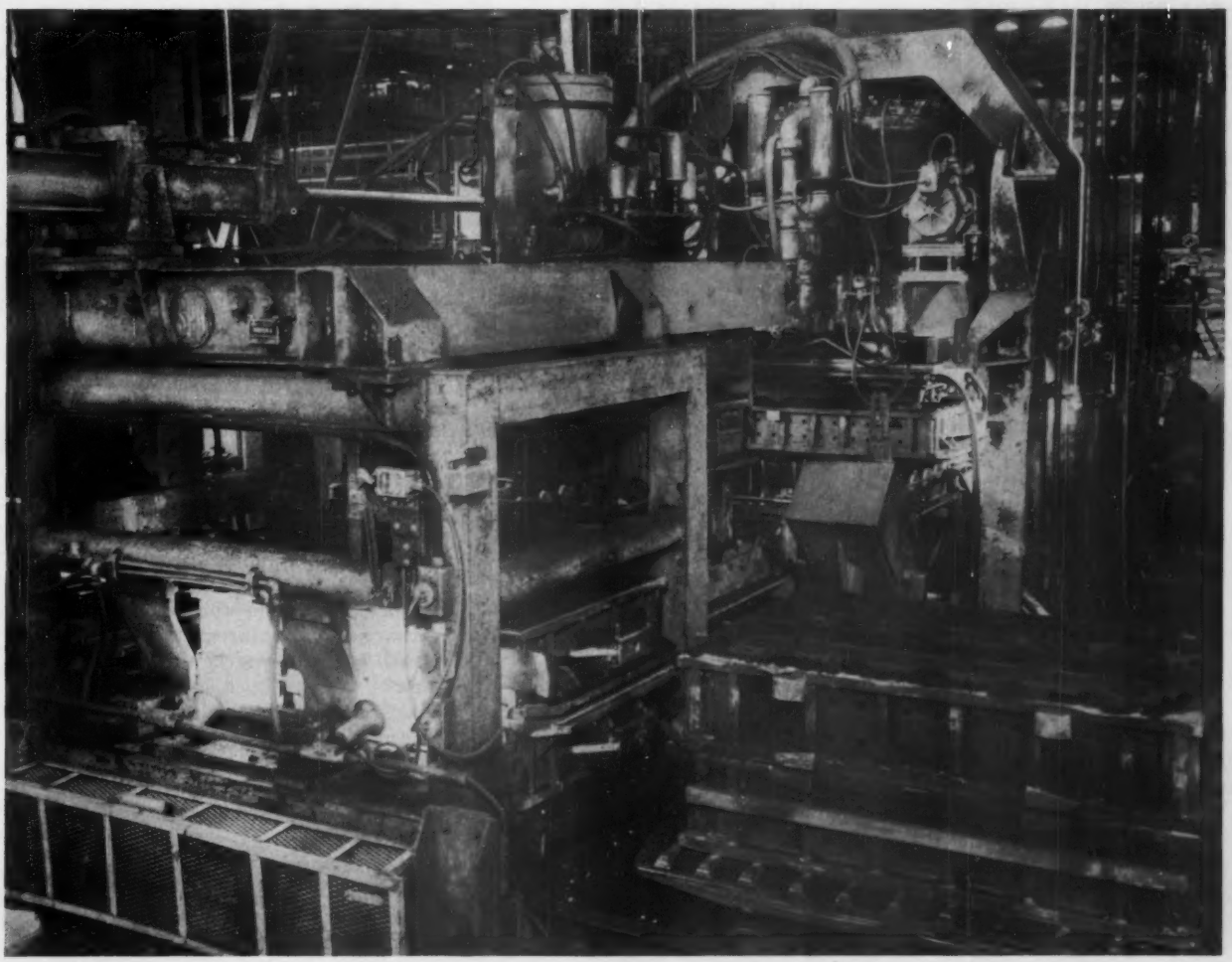
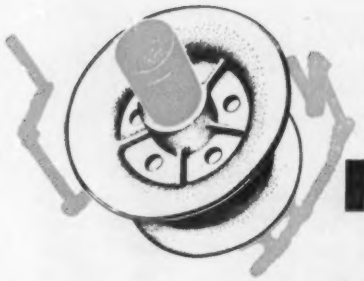
Each mold contains three cavities. Cope halves are made on the unit shown here, and molds are closed automatically at the station in the foreground





RISERING of Malleable Iron

The authors discuss functions of risers for malleable iron castings in our sixteenth article on gating and risering castings. Riser shapes, sizes, and locations are other factors covered

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Cleveland

● A RISER, by definition, is a reservoir connected to a casting. It provides liquid metal for the part during freezing, to compensate for the internal shrinkage encountered during cooling and solidification. Thus, the primary function of a riser is to produce castings which are metallurgically sound. In performing this function a riser also promotes directional solidification in a casting.

Before discussing riser shapes, sizes, and other considerations, it is important to pinpoint the defects we hope to combat through improvements in risering technique. The most common metallurgical defects caused by inadequate risering are gross and/or center-line shrinkage, internal hot tears, sinks, and shrinkage porosity. Low casting yield, lost production time, and embarrassing service failures may be related to poor risering technique.

In certain instances, shrinkage or areas of low metal density will not affect adversely the functional service of the casting. In such cases, changes in risering are not necessary. When the inspection and service requirements are stringent and call for x-ray soundness, however, it will be advantageous to eliminate the shrink through adequate risering while the job still is in the pilot-run stage.

Wallace[1] stated the requirements of a riser to be as follows: 1) it must have sufficient volume to compensate for liquid and solidification contraction, and 2) it must remain liquid longer than the casting it is intended to feed.

Since these requirements hinge on certain fundamental characteristics of the metal, a brief discussion of the basic principles of solidification for white iron, from which malleable castings are made, is in order.

Solidification Mechanism—When molten metal is poured into a mold, the metal will start to solidify in the area adjacent to the mold wall. A thin layer of equiaxed grains will form first, after which solidification will progress toward the hottest portion of the casting at a rate governed by the heat extraction characteristics of the mold material. Dendrites will grow perpendicular to the mold walls toward the thermal center of the casting as shown in Fig. 2. This illustrates the thin layer of a chilled zone and the mushy zone with dendrites extending into the liquid portion of the part.

As metal cools and solidifies, the areas between the branches of the dendrites in the mushy zone must be filled to prevent voids and porosity. The solidification range, graphically depicted in the iron-carbon diagram for white irons of malleable composition, is wide, between 200° and 350° F, and this calls for precaution in feeding castings adequately.

Another factor to consider is that white irons are eutectic-forming alloys; approximately 30 per cent of the liquid metal freezes as an austenite-Fe_3C eutectic. This accounts for the large volume change on solidification when comparing malleable iron to steels which freeze mainly in the delta iron or austenitic form.[2]

Chvorinov[3] advanced certain theoretical considerations for risering which have formed the background for most of the work done in this field. Chvorinov's rule states that the time necessary for a casting to solidify completely will be proportional to the square of the volume and inversely proportional to the square of the surface area. As mentioned, one of the basic requirements of a riser is that it remain liquid longer than the casting it is intended to feed. Using Chvorinov's rule, the following equation can be established:

$t = R^2/M^2$, where t is solidification time, R equals volume/surface area, and M = solidification constant for the metal being cast.

The foundryman can calculate

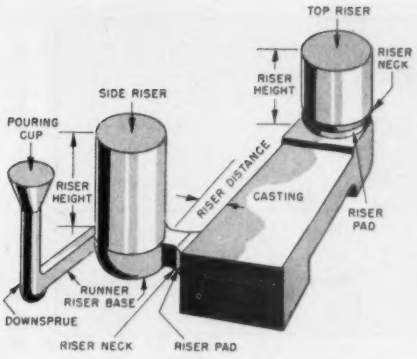


Fig. 1 — Riser-gated casting drawn here illustrates components of a casting system[9]

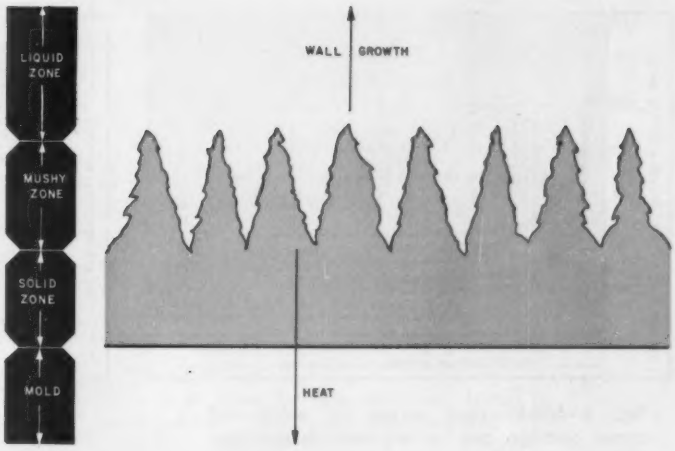


Fig. 2—This schematic presentation shows the growth of dendrites during the early stages of solidification of a casting[2]

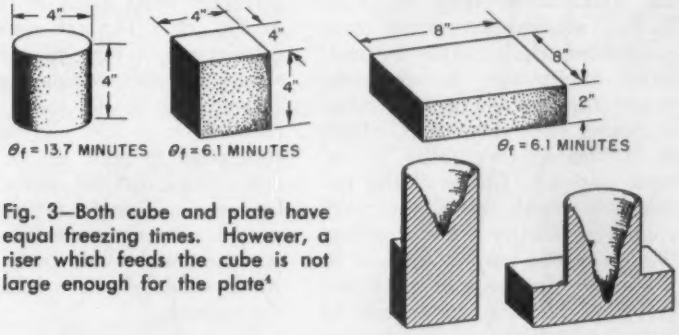


Fig. 3—Both cube and plate have equal freezing times. However, a riser which feeds the cube is not large enough for the plate[4]

the time required for a given casting to solidify, and can then dimension his riser so that it takes longer to freeze than the casting. He will not be assured of a sound casting, however, for Chvorinov's rule omits a factor to compensate for solidification shrinkage.

A revealing illustration of this point[4] is shown in Fig. 3. Although the volume-surface area ratios for the plate and the cube are equal, as also are their solidification times, the riser shown will not feed the plate. Based on Chvorinov's rule, sound castings should result, for the riser has a solidification time much greater than the test pieces. The reason for the unsoundness of the plate is that its volume is twice as great as that of the cube; consequently, it has a greater solidification shrinkage.

Other Studies—With Chvorinov's work serving as a basis, Caine[5, 6] and others have developed modifications which permit the foundryman to calculate riser dimensions accurately to insure against unsound castings. A research program, based on the principles advanced by Chvorinov and Caine, was pursued by the Malleable Founders Society[7], and some of the findings related to risering malleable iron will be discussed next.

Using as parameters the volume

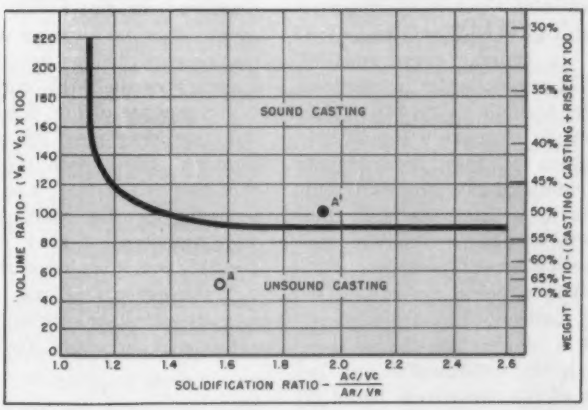
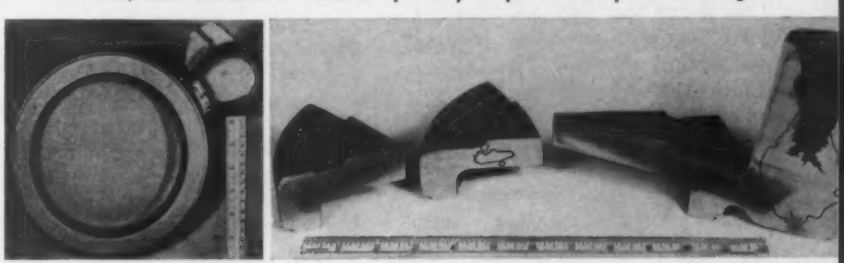


Fig. 4—This is a typical curve used for risering malleable iron castings with a single blind side riser

Fig. 5—Casting corresponding to point A in Fig. 4 is sound on the surface, but sectioned views show porosity as predicted by curve in Fig. 4



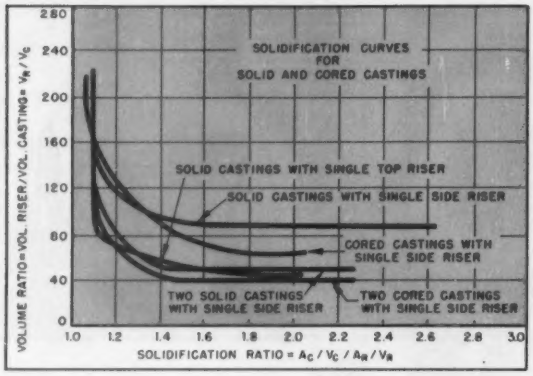

SOLIDIFICATION CURVES FOR SOLID AND CORED CASTINGS
SOLID CASTINGS WITH SINGLE TOP RISER
SOLID CASTINGS WITH SINGLE SIDE RISER
CORED CASTINGS WITH SINGLE SIDE RISER
TWO SOLID CASTINGS WITH SINGLE SIDE RISER
TWO CORED CASTINGS WITH SINGLE SIDE RISER
VOLUME RATIO=VOL. RISER/VOL. CASTING= V_R/V_C
SOLIDIFICATION RATIO = $A_C/V_C / A_R/V_R$

Fig. 6—Solidification curves for solid and cored castings, one or two castings per riser

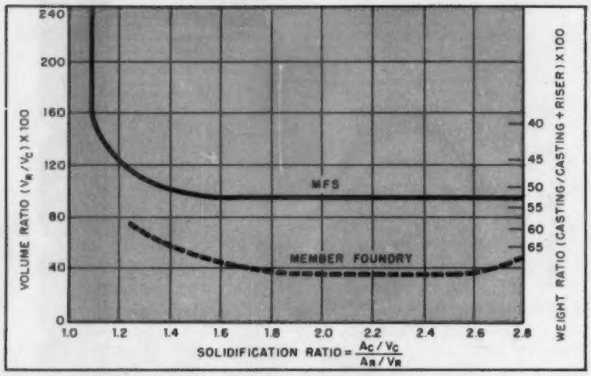


Fig. 7—Composite curve derived from Fig. 6 is compared with curve developed by an MFS member

ratio of riser to casting (V_r/V_c) and the solidification ratio ($A_c/V_c + A_r/V_r$), solidification curves were constructed which enable the malleable foundryman to select the proper riser size for a wide range of casting sizes and shapes. (Suffix "r" denotes riser, suffix "c" denotes casting.) Curves of this nature also permit use of the minimum riser size for a given casting, thus increasing casting yield.

It should be borne in mind that before solidification curves can be utilized effectively, the foundryman must estimate the size of the riser required and make a sample calculation. In general, risers must be 15 to 25 per cent larger in diameter than the sections to be fed. Also, it is cheaper to make a few sample calculations of riser requirements before conducting a pilot run than to guess at a riser size and then change it several times before putting the job in the sand.

Fig. 4 is a typical curve used for risering malleable iron castings employing a single, side blind riser. Although the co-ordinates and intercepts of the curve were based on theoretical concepts, the actual shape of the curve was determined from experiments on hollow and solid plates and cylinders using various compositions of white iron. The points on this solidification curve represent an actual production casting, shown in Fig. 5a.

Calculations of the volume and solidification ratios gave values of 48 and 1.57, respectively, for the original design of the casting and riser. These values correspond to point A on Fig. 4, which is located in the unsound region. The casting was sectioned and etched, with shrinkage being found as indicated in Fig. 5b. Through appropriate calculations, a new riser was designed for this casting having a volume ratio of 101 and a solidification ratio of 1.95. These values correspond to point A' on Fig. 4 and indicate that the casting should be sound. Sample castings were poured, using the corrected riser dimensions, and found to be sound, which validated the conclusions of the research.

Fig. 6 shows solidification curves developed by the Society for both solid and cored castings with either one or two castings per riser. Fig. 7 compares the MFS curve, which is a composite of Fig. 6 with a similar one developed by a member foundry. These data indicate that the Society's curve was too conservative for this particular foundry's practices. Stated differently, the MFS solidification curves should be applicable to all malleable foundries, but to get optimum results, each foundry should make certain modifications to adapt the research to its own individual requirements.

In view of the fact that the calculation of a casting's surface area is at times an arduous task, it is frequently desirable to have solidification curves which exclude casting area from the parameters.

Requirements—To eliminate casting and riser area from the co-ordinates of the curves, three conditions have to be met: First, a riser with standardized proportions has to be established. Second, castings must be classified into basic geometric shapes. This necessitates considering only simple shapes or sections of castings to be fed individually. Third, some relation must be developed between casting dimension and the variation in rate of solidification time for simple shapes, as A_c/V_c had done previously.

Recent solidification studies by the Naval Research Laboratory[8] have shown that the shape factor of simple castings, i.e., bars, plates, etc., can be described by a simple

TABLE 1—Effect of Riser Tops on Feeding Efficiency

RISER TYPES	DIAMETER (IN.)	TOTAL HT. (IN.)	DOME HT. (IN.)	DOME RADIUS (IN.)	RISER RADIUS (IN.)	HEIGHT TO DOME (IN.)	NET AREA (SQ IN.)	VOLUME (CU IN.)	RATIO, AREA TO VOLUME	RATIO, TOTAL HT. TO DIAM.
TYPE 1	1.676	2.095	.838	.838	.838	1.257	11.83	3.95	2.99	1.25
TYPE 2	1.654	2.068	.420	1.025	.827	1.648	12.03	3.98	3.03	1.25
TYPE 3	1.600	2.00	-------	-------	.800	2.00	12.71	3.97	3.21	1.25

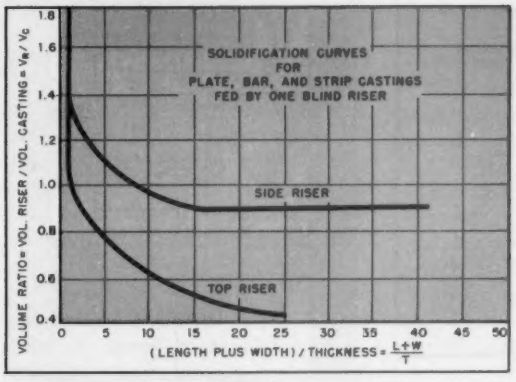

SOLIDIFICATION CURVES FOR PLATE, BAR, AND STRIP CASTINGS FED BY ONE BLIND RISER
SIDE RISER
TOP RISER
VOLUME RATIO = VOL. RISER / VOL. CASTING = V_R / V_C
(LENGTH PLUS WIDTH) / THICKNESS = $\frac{L+W}{T}$

Fig. 8—Simplified solidification curves for various castings fed by a single blind riser

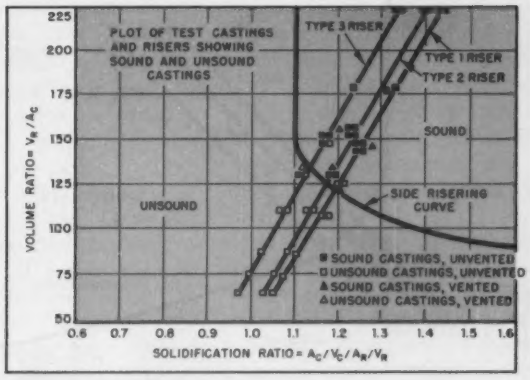

PLOT OF TEST CASTINGS AND RISERS SHOWING SOUND AND UNSOUND CASTINGS
TYPE 3 RISER
TYPE 1 RISER
TYPE 2 RISER
SOUND
UNSOUND
SIDE RISERING CURVE
SOUND CASTINGS, UNVENTED
UNSOUND CASTINGS, UNVENTED
SOUND CASTINGS, VENTED
UNSOUND CASTINGS, VENTED
VOLUME RATIO = V_R / A_C
SOLIDIFICATION RATIO = $A_C / V_C / A_R / V_R$

Fig. 9—A curve for side risers was tested in this manner. Riser types refer to Table I

relationship of length, width, and thickness equal to (L+W)/T. Any plot of this relationship versus riser size is as accurate as solidification ratio versus volume ratio curves for cubes, bars, and plates. It can be used as an approximation for semi-bars and semi-plates and sections of castings to be fed individually by live risers, but is inaccurate for more complex castings. Fig. 8 presents a simplified plot of the solidification curve for simple shapes fed by a single blind riser for both side and top feeding.

Riser Shape—The next facet of risering to be considered is that of riser shape. Since it is necessary to keep the riser metal molten as long as possible, it is desirable to design the riser to have the lowest surface area per unit volume to minimize heat loss. Theoretically, a sphere would make the best riser shape, but a spherical shape presents certain problems which preclude its use. These problems include molding difficulties, space requirements on a plate, and the fact that ferrostatic pressure is less for a sphere than for a cylinder of equal volume, provided both are gated in the same location.

Table I shows three different cylindrical riser shapes studied in the MFS research to determine the effect of riser tops on feeding efficiency. In this work, ratios of volume and height to diameter were kept constant. Initially, all test castings were fed by an unvented riser, and it was found that a Type 2 riser was the most effective. Green sand vents were then added to the Type 1, 2, and 3 riser shapes and additional tests were run. In this work, no appreciable change in riser efficiency was noted with the Type 2 and 3 tops, but the vent was beneficial to the Type 1 riser. Fig. 9 presents the results of these experiments.

These conclusions can be drawn from this phase of the research:

1. Extremely convex or spherically shaped riser tops are not as effective as theoretically anticipated, due to their relative inability to vent themselves properly.

2. The most efficient unvented riser top is one that is slightly rounded or has an upper edge with a large radius—such as the Type 2 shape. Fig. 10 plots area and volume versus riser diameter for feeders of comparable proportions.

3. The most effective vented riser top is hemispherical in shape. It is, however, only slightly more efficient than the slightly rounded top without a vent.

The experienced foundryman recognizes that, to produce sound castings, his risers must not only have sufficient feed metal available, but they also must be properly shaped and proportioned. Frequently a riser must be designed to an irregular shape to accommodate a flask bar or some other rigging, and this irregular shape often is accompanied by unsound castings.

Difficulty also is encountered when a poorly proportioned riser of sufficient volume is used. MFS research indicates that the most effective ratio of height to diameter for cylindrical risers is 1.25:1. Experience and tests have shown that when this ratio exceeds 1.5:1, no

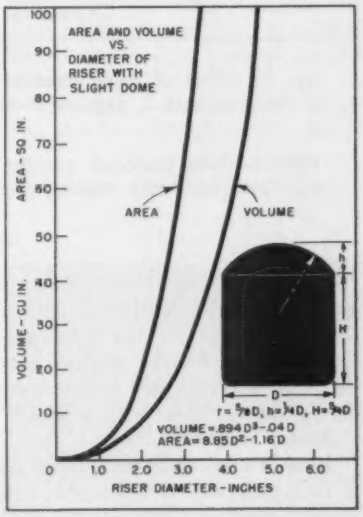

AREA AND VOLUME VS. DIAMETER OF RISER WITH SLIGHT DOME
AREA
VOLUME
AREA - SQ IN.
VOLUME - CU IN.
RISER DIAMETER - INCHES
VOLUME = .894 D^3 - .04 D
AREA = 8.85 D^2 - 1.16 D

Fig. 10—Area and volume of a riser with a slight dome are plotted versus riser diameter

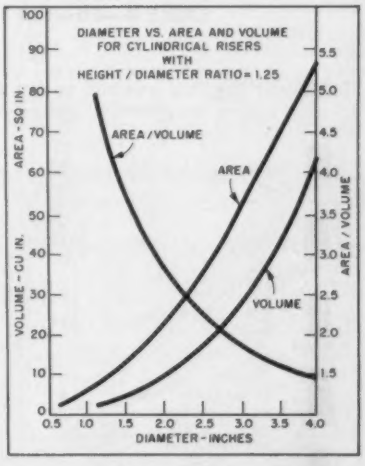

DIAMETER VS. AREA AND VOLUME FOR CYLINDRICAL RISERS WITH HEIGHT / DIAMETER RATIO = 1.25
AREA / VOLUME
AREA
VOLUME
AREA - SQ IN.
VOLUME - CU IN.
AREA / VOLUME
DIAMETER - INCHES

Fig. 11—Diameter vs area and volume, cylindrical risers with height-diameter ratios of 1.25

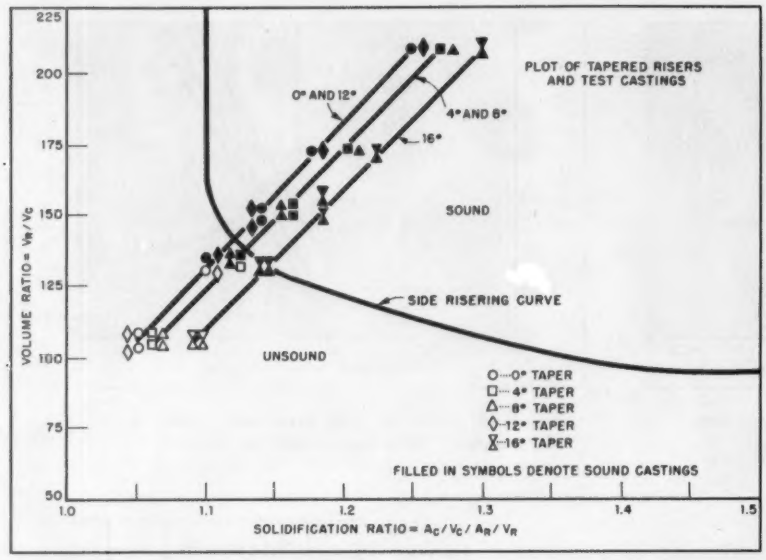


Fig. 12—Effect of cope taper on riser efficiency. In borderline cases, a riser taper of 8 degrees seemed to give the most consistent results

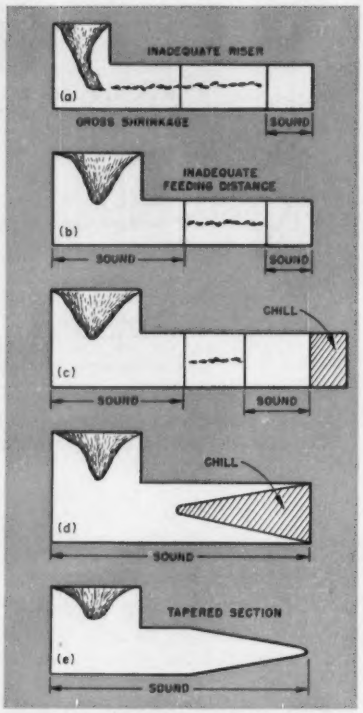


Fig. 13—These sectioned castings represent effects of feeding distance, riser adequacy, and thermal gradient distribution on casting soundness

increase in riser effectiveness is gained, for the additional height tends merely to feed the lower part of the riser.[9] Fig. 11 presents data on area, volume, and area/volume for cylindrical risers with a height/diameter ratio of 1.25:1.

Riser Taper—Although taper on a riser generally is consistent with normal draft requirements for good molding practice, opinion varies as to the effect of taper on a riser's efficiency. A change in taper would be expected to alter the solidification and venting characteristics. Table II presents data on the various cope tapered risers investigated.

Results of this phase of the investigation showed that no appreciable change in riser efficiency resulted from tapering risers, as long as their plots were in the sound portion of the solidification curve. In borderline cases, a riser taper of 8 degrees gave the most consistent results, but these were still considered unpredictable (Fig. 12).

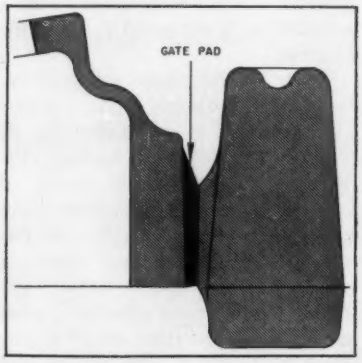
It is well established that ample taper on a casting will promote directional solidification from the lighter section toward the heavier portion, to which a riser is attached. There has been considerable discussion as to what extent taper on a casting contributes to the freezing of white irons in section thicknesses common to the malleable industry. Research was conducted to deter-

TABLE II—Effect of Taper on Riser Efficiency

RISER TYPES	DEGREE OF TAPER	DIAMETER (IN.) AT		TOTAL HEIGHT (IN.)	NET AREA* (SQ IN.)	TOTAL VOLUME (CU IN.)	RATIO, HEIGHT TO DIAMETER	RATIO, AREA TO VOLUME
		PARTING	TOP					
P.L. TYPE 3	0	1.60	1.60	2.32	14.42	4.60	1.45	3.14
P.L. TYPE 2	4	1.65	1.47	2.32	14.21	4.60	1.40	3.09
P.L. TYPE 4	8	1.66	1.24	2.50	14.21	4.60	1.50	3.09
P.L. TYPE 1	12	1.68	.88	2.87	14.46	4.60	1.71	3.14
P.L. TYPE 5	16	1.77	.91	2.50	13.94	4.60	1.41	3.03

* TOTAL AREA MINUS GATE AREA

Fig. 14—Padding a heavy section of this casting insures soundness high up in the pad



mine what effect taper might have in improving the efficiency of any given riser. This work was limited to commercially practicable degrees of taper—1 to 4 degrees—which could feasibly be added to malleable castings for the purpose of improving metal yield. The general conclusion drawn from this work was that tapers did not appreciably affect riser efficiency.

Riser Location—This is a very important consideration. Risers must be placed so that they exert a positive pressure on the molten metal in all parts of the mold and establish favorable thermal gradients within the casting.

If favorable thermal gradients are not established, centerline or dispersed shrinkage will be experienced. Fig. 13 shows the interaction of riser size, feeding distance, and thermal gradients in a cast plate. In all cases the end farthest from the riser was sound. This is due to the fact that more surface area is available for heat dissipation to establish favorable thermal gradients. This phenomenon, known as the "cold end effect," can be created by chilling, tapering, or a combination of both which is illustrated in Fig. 13d and 13e. Among other factors which exert an influence in riser placement, the following are important: Molding material used, variations in section thickness, location of chills, ease of removal, and feeding distance of the metal.

In many cases, directional solidification can be attained only through a change in casting design or by the addition of metal at the gate area or riser neck, which is commonly referred to as padding.

The use of gate pads can, in many instances, serve to promote sound castings which otherwise could be produced only by very complicated and costly gating and risering systems. Fig. 14 shows padding on a heavy casting section which is joined to a thin section. Without the additional metal on the heavy section, shrinkage occurred high up in the pad. When the gate was increased in height to feed out the shrink, heavy breakage was encountered in spruing.

Feeding Distance—A very important metal characteristic which the foundryman must consider when designing his gating system is the feeding distance of the particular material. This variable depends on the temperature range between liquidus and solidus, solidification temperature, thermal conductivity, specific heat, and heat of fusion of the solidifying metal.[1]

MFS research on feeding distance is summarized in Fig. 15. The feeding distance of plates is longer than for cylindrical bars. For thin-sectioned castings, a feeding distance up to ten times the metal thickness has been found possible. A conservative figure for a range of castings having sections varying from 1/4 to 1 in. would be a feeding distance of five times the thickness. In general, the feeding distance of malleable iron for heavier sections is similar to that of steel, i.e., sound castings result when a feeding distance of up to about 5T is used; distances of 5T to 10T are considered borderline, and above 10T shrinkage will almost always occur.

It is commonly accepted that a series of risers will require a much larger combined volume than if a single riser and gate is used. Fig. 16 (left) shows a differential bearing cap cluster which had a riser for each cap. Although the casting yield was only 37 per cent, there was shrinkage in the castings. By padding in between the individual bearing caps, it was possible to produce sound castings with a yield of 56 per cent. This is shown on the right in Fig. 16.

The feeding distance of malleable iron can be extended by the use of chills. A 20 per cent increase can be expected by the judicious selec-

Fig. 17 — Ceramic-coated chills of white iron aid directional solidification in this casting

Fig. 15—This plot shows feeding distance versus thickness of section for malleable iron

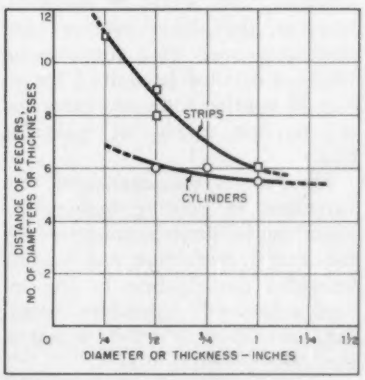
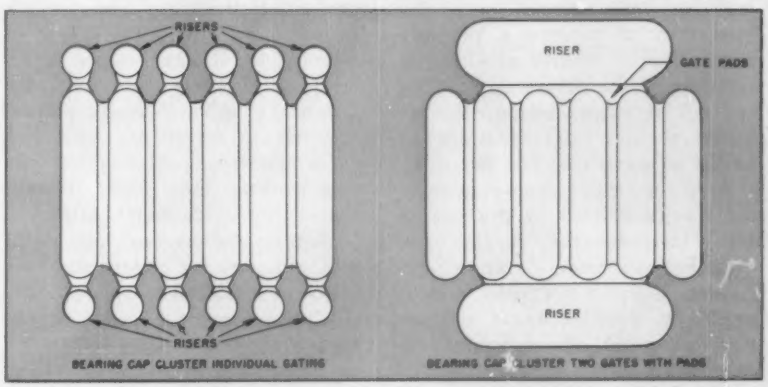


Fig. 16—Redesign of risers (right) plus use of padding between castings increased yield and gave improved soundness over original design (left)



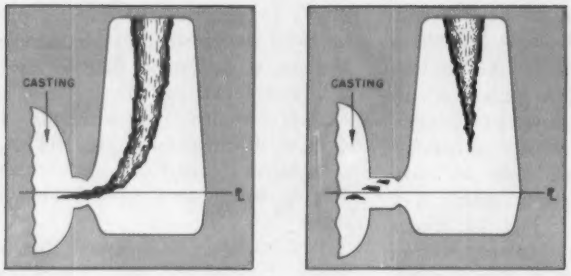


Fig. 18—This riser (left) was not adequate to feed its casting. Fig. 19—Another cause of shrinkage, shown on the right, is an inadequate riser neck

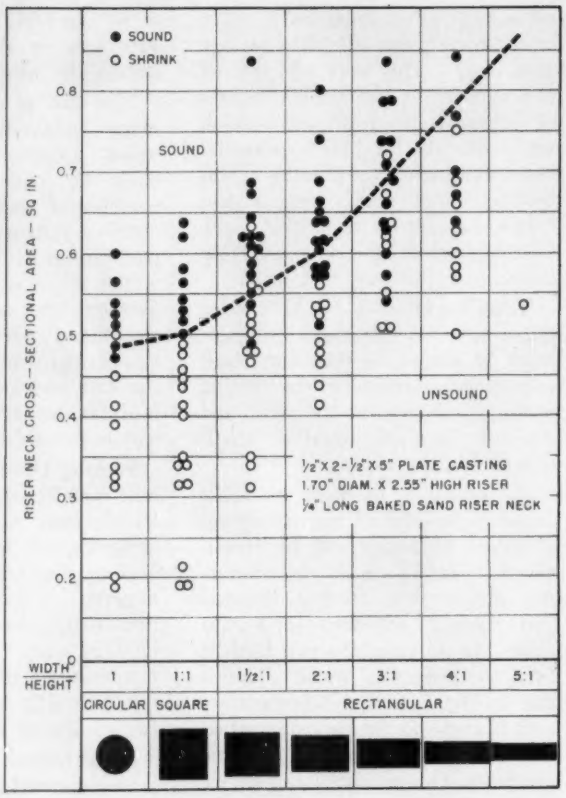


Fig. 20—Data plotted on this graph were determined to demonstrate the effect of riser neck shape and cross-sectional area on casting soundness

tion of chill size and location. When using chills in green sand castings, it is imperative that they be clean and dry, otherwise blows and other surface defects will occur in the area adjacent to the chill. Fig. 17 shows ceramic-coated white iron chills and a core assembly for a truck differential carrier.[10] These chills promote cooling and enhance directional solidification in the central portion of the carrier and impart optimum properties.

Even though the location of the riser and the gating system for the casting may be correct, it is still possible to experience shrinkage. This can be the result of inadequate riser size as shown in Fig. 18, or inadequate riser neck size as shown in Fig. 19. When the latter condition exists, other measures must be taken to produce sound castings.

Riser Necks—A thorough investigation on riser necks was carried out by MFS. Results of this work are summarized below:

1. The riser neck with circular cross section is the most effective, since its high cross-sectional to surface area ratio permits use of the least area to produce a properly run casting. Nearly as effective, however, is the square neck. The rectangular shapes become less effective as the ratio of width to height increases (see Fig. 20).

2. As the casting ratio (square of the volume divided by the surface area) increases—that is, the castings become more "chunky,"—a greater minimum riser neck area is needed to produce sound castings with gates of all configurations. (Fig. 21).

3. As castings become more massive, i.e., the casting ratio increases, rectangular riser necks become increasingly less efficient than round or square riser necks (Fig. 20).

4. Fig. 22 shows an interesting plot of casting ratio versus riser neck area and feeder size for open-end, cored cylinders. This graph can be used to determine the feeder size and gate area necessary to produce sound, open-end, cored castings, provided the feeder proportions shown are adopted.

Foundries which use different feeder proportions can adapt the plot shown by the derivation of similar curves reflecting their own production practices. The graph is intended for use with square or round gates. If other shapes, which feed less effectively, are used, the gate area must be increased proportionately in accordance with Fig. 20, which depicts the required gate cross-sectional area, using different shapes to produce sound castings.

Data on the per cent increase in area necessary for rectangular riser necks, as compared to square or circular cross-sectional necks to obtain equivalent feeding efficiency, are shown below:

Riser Neck Width/Height Ratio	Per Cent of Riser Neck Area Required
1 (square)	100
1½ (rectangular)	110
2 (rectangular)	120
3 (rectangular)	140
4 (rectangular)	160

These figures become increasingly significant in the light of gate removal costs.

For the particular types of production castings investigated, it was found that a variation in pouring rate from 50 to 200 lb a minute appeared to have little or no effect on the amount of shrinkage in the castings. As might be expected, however, the higher pouring rates may cause more slag entrainment. (A more detailed account of the effects of pouring rates was presented in the first article on malleable iron.)

Likewise, it was concluded that variations in pouring temperature —within the limits encountered by the several production and jobbing foundries participating in the investigation—will, generally speaking, have no effect on the extent of shrinkage in white iron.

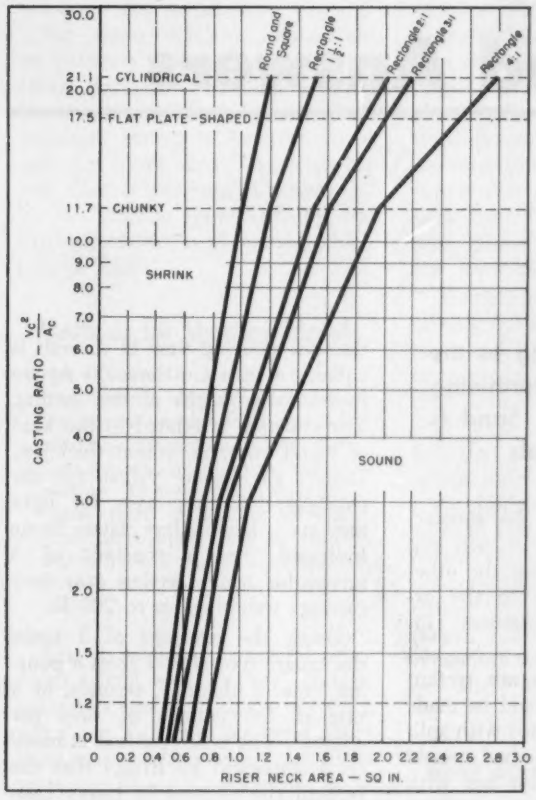


Fig. 21—Graph shows proper riser neck areas for castings of various shapes and ratios

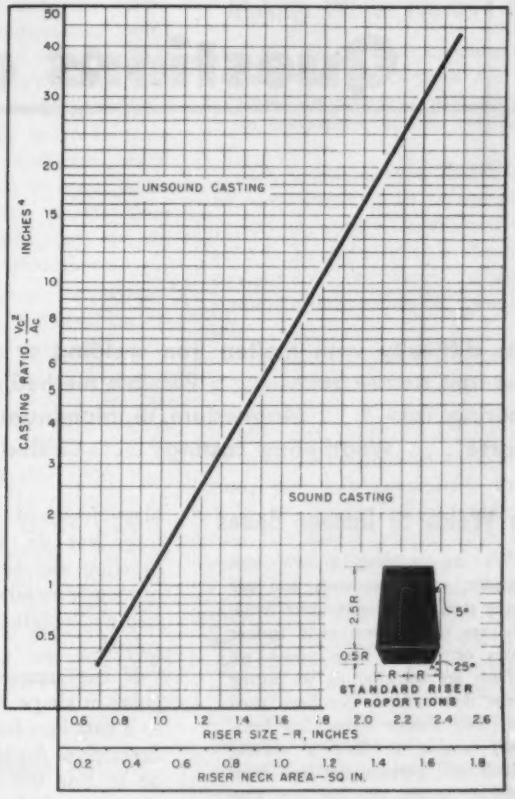


Fig. 22—Plot shows casting ratio versus riser size and neck area for open-end cylinders

Careful attention to fundamentals is required to insure soundness in castings, and in deciding on the location and dimensions of the gate necessary to permit satisfactory feeding of metal through all sections of a casting. Fig. 23 shows an original and a redesign dealing with this problem.[10] In the original, the thin metal section around the boss was not sufficient for proper gating and feeding; in the redesign the thin section was eliminated to permit gating and feeding directly into the boss.

The writers gratefully acknowledge the invaluable assistance so graciously rendered by C. Russell Baker, chief engineer, Albion Malleable Iron Co., in the preparation of this manuscript.

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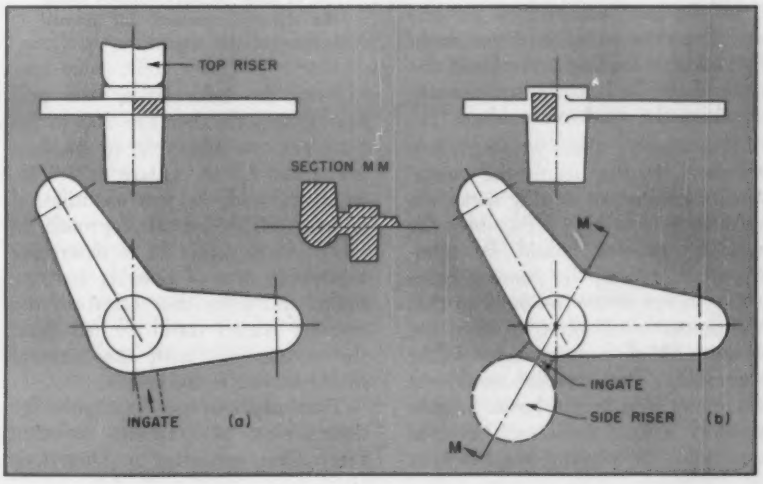

Fig. 23—Alteration of casting design and gating system (b) was necessary to obtain proper feeding of this casting

Questions and Answers

Has difficulty with molten iron welding or sticking to the cast iron runner boxes . . . Possible method of determining pouring rate . . . Magnesium in aluminum . . . Sand is coarse . . . Weathering castings . . . Chilled wheels

Iron Welds to Runner Boxes

We are building a new iron foundry, semi-automated, and are doing stack molding in green sand. We are using green sand runner boxes or pouring cups which we believe are contributing to casting losses due to dirt. We have tried cast iron runner boxes, but have been unable to find a coating which will prevent the iron from welding to the pouring cup. Our pouring temperatures are about 2750 to 2800° F. Have you any suggestions?

You do not mention what types of coating materials you have tried, and suppose those which have been applied are the usual mixtures of silica flour with some adhesive such as bentonite, and with or without a small quantity of sodium silicate or water glass to aid in suspending the materials in water.

Your reference to runner boxes and pouring cups is not quite clear to us, but we suspect they are one and the same—that is, a rectangular basin extending from near the edge of the flask to the sprue opening into the stack of molds.

Presumably the welding you mention results from the metal stream eroding or cutting away the refractory coating. Possibly the welding problem could be eliminated by raising the pouring basin a few inches above the mold so that the pourer could observe when the sprue is filled, and then stop filling the mold. That practice would not leave any iron in the basin. Again possibly a lime wash such as used on molds in pigging machines at blast furnaces might be satisfactory, but we suspect it will not function any better than the other refractory washes due to the extremely high temperatures involved.

If the runner boxes are rectangular in shape, they could be made as a cast iron frame lined with split firebrick. Another method would be to line the cast iron box with zircon sand bonded with sodium silicate, and to gas it with carbon dioxide.

Figuring the Pouring Rate

In our steel foundry in Argentina we have orders to produce small 300-lb ingots of plain carbon steel in the SAE 1010 and 1050 types, and in sufficiently large quantities. We plan to use the bottom pouring system employing runner tile with a diameter of about 1¾ in. and a total horizontal length of 25 to 30 in. Ingots will be about 4 ft long. What maximum speed can we admit in these runners without losing the dynamic pressure for normal feeding of the ingots?

From the information you present it appears that the 300 lb ingots you are planning to produce are about 4.7 in. square or 5.3 in. in diam, and, as you mention, 4 ft long. The logical approach to the problem would be to determine a suitable rate of pouring for one ingot, and from that ascertain the number which could be fed from the runner tile with the internal diameter you mention.

Two methods are available for determining a suitable pouring rate. One, according to Dietert, is that the pouring time in seconds is equal to a constant times the square root of the weight of the casting. The constant is related to the kind of metal and the section thickness. Dietert gave some values for the constant, but they were for light sections. Some time later Stone indicated that a constant of 3 served for heavy section gray iron castings weighing up to 200 lb.

Using the constant of 3 times the square root of 300 gives a pouring time of about 52 seconds, or a rate of 5.8 pounds of steel per second. The other method is based on a statement by Briggs that the vertical rise of steel in heavy castings is about 1 in. per second. Using the cross sectional area of 4.7 x 4.7 in., and the weight of molten steel as 0.252 lb per cu in., the rate of metal rise in the ingot would be about 5.6 lb per second—which agrees rather closely with the first method of calculation.

Next the capacity of the runner should be determined so that the number of castings which can be fed can be ascertained. A rough figure given in the literature indicates that each square inch of cross-sectional area will carry about 16 lb of metal per second. Since the runner is 1¾ in. in diam, the cross-sectional area is about 2.4 sq in. and its carrying capacity would be about 38.4 lb per second. Hence, the number of castings or ingots which could be fed would be 38.4 divided by 5.8 or approximately 7.

It should be pointed out, however, that these calculations are only approximations since it would be expected that the high head of at least 4 ft would produce a higher flow rate in the runner. Also, no consideration has been given to frictional, bend, and other losses which might occur in the system, and which might make considerable difference in the figures indi-

cated in the calculations given.

For more detailed information on gating systems we suggest you obtain copies of *The Flow of Steel in Molds* published by the Steel Founders' Society of America which sells for $3.50, and *The Running and Gating of Sand Castings* by R. W. Ruddle, published by the Institute of Metals (London) which sells of $4.65.

Methods for Shotting Metal

We intend to reopen a small brass foundry. In our former melting practice we used small pieces of slab zinc to compensate for that lost through volatilization during melting. However, that always involves labor in hacking off the small pieces required, and we would like to know if zinc in more finely divided form than slabs is available.

Zinc is available in several other forms than slab. They include shot, stick, rod, and sheet, but since you have slab zinc on hand there is no reason why you can not make your own shot. One method is to pour molten zinc slowly from a small ladle held a few feet above a pail of water.

Another way would be to pour from the same height onto a board set at an angle of 45 degrees and projecting into the water pail about half the width of the pail opening. Have the metal stream strike the board about half way between the lower end and the edge of the pail. Still another method would be to pour the molten zinc slowly through a piece of ⅛-in.-mesh screen held a couple of feet above the pail of water.

Handling of Sulfuric Acid

We operate a foundry in Mexico, and would like to have information on the best analysis for a water pump that has to handle sulfuric acid of a concentration of 20 per cent at a working temperature of 80° C.

Without full details on the sulfuric acid to be handled, it is hazardous to make definite statements on suitable metal or alloy compositions which might serve. For example, if the acid is aerated to any extent its corrosion rate increases considerably; also, if contaminated with certain metal salts, the corrosion rates may increase to point that some alloys and metals which might be satisfactory with acid alone cannot be employed. Agitation also may result in an increase in corrosion rate, and we would expect that situation to occur more with centrifugal type pumps than with piston type although we do not have definite information.

Possibly an aluminum bronze containing 9.3 to 10.3 per cent aluminum and 3.0 to 3.7 per cent iron, or one containing 10.5 to 11.2 per cent aluminum and 3.3 to 4.0 per cent iron, might be satisfactory, but that can be determined definitely only by suitable field testing. Again it may be necessary to turn to one of the highly alloyed, corrosion-resistant steels. Perhaps one containing 19 to 22 per cent chromium, 27.5 to 30.5 per cent nickel, 1.25 to 2.50 per cent molybdenum, and 3.0 per cent copper might be the answer.

Alloy Steel Is More Suitable

Would it be possible to replace high-manganese steel bucket bushings used on tin dredges with centrifugally-cast, composite bushings made with an outer layer of tough alloy steel and an inner layer of alloy white iron? Would these offer greater wear resistance than is possible with the manganese steel?

The bushings have to withstand crushing stresses and shock loads in the service of tin and gold dredging, and we wonder whether that would cause cracking of the white iron lining. Bushings are about 5 in. ID with 1¼ in. walls and are 16 in. long.

Although it would be possible to produce a composite bushing with an outer alloy steel layer and an inner alloy white iron layer, we believe that under the stresses to which the bushings are subjected in service, the hard iron would crack. Also we believe that even if the hard alloy iron would stand up without cracking, it would not give as long a life as manganese steel, but would wear out more readily. Bushings for buckets used on dredges for tin or gold or on harbor ladder dredges are good applications of manganese steel, according to experience in this country.

Making White Fracture Iron

We are interested in white cast iron, and will appreciate any information, especially with relation to composition of the material.

As you undoubtedly know, white-fracture iron can be produced in a variety of ways. Commonest probably is by reduction of the silicon content to the point where its graphitization effect is practically nil.

Amount of reduction will depend on section size. For example, an iron with a silicon content of 2 per cent probably would result in a white fracture in a ⅛-in. section, but not necessarily in one 3/16 in. thick. With a 2-in. section the silicon might have to be reduced to 0.60 per cent or less.

Increasing the rate of solidification of the iron by use of chills is another method. The chills prevent the carbon in solution or combination as cementite from transforming or breaking down into pearlite and graphite. With use of chills of sufficient thickness in relation to section size, no change has to be made in silicon content. Also by use of chills and adjustment of silicon for section size, it is possible to obtain white iron at the interface of casting and chill which is backed up by gray iron.

Use of alloying agents which are strong carbide stabilizers such as chromium or tellurium, which prevent transformation of cementite into other combinations of iron and carbon, is a third method. Tellurium is much more drastic in its action than chromium, and addition of only a few grams per ton can produce a white-fracture iron.

An alloy iron said to give excellent results against abrasive wear is Ni-Hard developed by International Nickel Co. It may be cast in sand or in chills. Composition range essentially is 0.40 to 0.70 per cent Si, 0.40 to 0.70 per cent Mn, 0.15 per cent S max, 0.40 per cent P max, 4.00 to 4.75 per cent Ni, and 1.40 to 3.50 per cent Cr. Total carbon may be from 3.0 to 3.6 per cent. Brinell hardness of the sand-cast material ranges from 525 to 650, and for the chill-cast type the hardness range is 575 to 725. Castings must be given a stress-relief treatment at 400 to 450° F before placing them in service.

Determination of Magnesium

A few years ago a quick method for determination of magnesium was published in FOUNDRY. We believe it was called the quinolate method, using 8-hydroxyquinoline as a precipitating agent. We have mislaid the published description and when using our penciled notes, seem to come up with a heavy magnesium precipitate, even when using oxalate to remove calcium.

Although from time to time FOUNDRY publishes articles relating to methods of analysis, we were unable to locate one describing the use of 8-hydroxyquinoline in the determination of magnesium—particularly since no mention is made on wherein the magnesium occurs. However, search of other literature indicates that the chemical reagent mentioned is used in determination of magnesium in aluminum alloys.

In the method, various interfering elements in the aluminum alloy are removed, and the magnesium precipitated by the 8-hydroxyquinoline as magnesium hydroxyquinolate. Magnesium in the precipitate may be determined gravimetrically or volumetrically. Details of the complete procedure may be found in *Analysis of Aluminum Alloys* by Osborn and Stross, and in *Analytical Methods for Aluminum Alloys* published by Aluminum Smelters' Research Institute.

Should Use Finer Sand

We are forwarding a couple of brass castings with which we are having some trouble. They show pit holes, and cannot be finished smooth and slick. Also the castings crack when bent. Alloy is 85-5-5-5 purchased in ingot form. Can you suggest a more satisfactory alloy for this type of light hinge? Also what kind of molding sand and core sand should be used?

Major cause of your difficulty in obtaining a satisfactory polished and buffed surface is the kind of sand used. It is much too coarse for your castings unless you want to spend considerable time in rough polishing or cutting down, as it is termed, but that is a rather expensive procedure.

Although it is easy to say that a finer sand should be used, it is another matter to state what it should be. Practices and procedures vary from foundry to foundry, and a sand which is satisfactory in one will not function as well in another. As sands become finer, they are less permeable to gases, and you will have to compromise between fineness and permeability by selecting a sand which will not result in blows, but still provide a suitably smooth, as-cast surface.

It is suggested that you secure small batches of finer sands, and make up some molds. Observe the results obtained and select that which proves most suitable. We believe that a sand with an AFS grain fineness of 150 should serve. The same reasoning applies to core sand; try finer sand than you now are using.

With reference to bending the castings, we suggest the use of the 70 copper-30 zinc alloy commonly called dip metal or chandelier brass, if that is a requirement for the castings. This brass can be poured into thin sections and can be bent to shape when cold.

Aging of Gray Iron Castings

We are interested in obtaining information on aging of gray iron castings. Have any articles been published on the subject?

Use of the term "aging" presumably refers to the old practice, which probably is carried on to some extent today, of exposing castings to the outdoor atmosphere for several months prior to machining. That procedure appeared to give better dimensional stability than when the castings were machined without such weathering or seasoning. Some years ago, Sherwin stated that castings which have not been heat treated and left for a long period of time in the yard exposed to the weather were found to be seasoned to an extent about equal to that which the castings receive from heat treatment.

Later studies, however, do not agree with that statement. For example, P. A. Russell, *Foundry Trade Journal*, Sept. 5, 1946, described some work with test castings designed to incorporate stresses. The study indicated that castings exposed four months to varying atmospheres and temperatures showed a reduction of only 15 per cent in internal stresses. Machining of the specimens also provided some stress relief. Study by C. R. Tottle, *Proceedings*, Institute of British Foundrymen, 1947-48, indicated that weathering relieved stresses to an appreciable extent, and M. M. Hallett, *Foundry Trade Journal*, Aug. 11, 1949, set the figure of 10 per cent maximum stress relief on aging at room temperature for several months.

We do not believe aging, weathering or seasoning is practiced to any great extent today since it means a large inventory of castings. A short heat treatment at 950 to 1050° F for plain gray irons and somewhat higher for alloy type gray irons will provide up to 80 per cent stress relief, as pointed out in two articles by C. O. Burgess in the August and September, 1953, issues of FOUNDRY.

Handling Chilled Carwheels

Can you supply us with the following information relating to chill-iron carwheel manufacture: What is the most suitable pouring temperature, how long should the wheels remain in the mold, and what is the maximum time limit between shaking out and placing in the annealing pits?

One producer of chilled iron carwheels indicates that it has found for the particular practices followed that the least variation in chill depth and over-all shrinkage is obtained when the iron melted issues from the cupola at about 2650° F and is poured about 2425°. Although no definite information is available on the length of time that the wheel remains in the mold, it probably is until the sprue freezes over since mention is made that on shakeout the hub shows about 1900°, the plate or web 1550°, and the tread 1200° F. As you can see from the temperatures, the wheels are shaken out quite hot.

Investigation also has shown that best results are obtained when the wheels are placed in the annealing pits at an over-all average temperature of 1550° F, or about that on shakeout. It also has been determined that the temperature drop after shakeout ranges from 2.5 to 3° per minute and that if the wheels are placed in the pits within 2 to 7 minutes after shakeout, good results are obtained. Annealing time is around 72 hours.

CORE HARDENING TIME CUT

from 3 hours to 15 seconds*

...WITH PURECO CO_2 "FLASH CURING"

The Pureco CO_2 *Flash Curing* process can mean extensive savings in time and money to you. Hardening time is cut from hours to seconds . . . no costly baking ovens or core driers are needed . . . valuable space is saved . . . more accurate castings with smoother finish result. Mold drying is eliminated . . . rapid production of finished cores expedite rush orders. In-plant handling time is drastically reduced.

For production or custom work.

Pureco can tailor a *Flash Curing* installation to meet your specific foundry requirements —large or small. Cost is low—installation simple.

Have a trial Flash Curing demonstration.

Pureco would like to demonstrate its *Flash Curing* process in *your foundry* under *your working conditions*, with no obligation on your part. Call your local Pureco man or write:

**Actual Pureco test*

PURECO CO_2

PURE CARBONIC

Pure Carbonic Company, A Division of Air Reduction Company, Incorporated
Nation-Wide Pureco CO_2 Service-Distributing Stations in Principal Cities
General Offices: 150 East 42nd Street, New York 17, N.Y.

AT THE FRONTIERS OF PROGRESS YOU'LL FIND AN AIR REDUCTION PRODUCT

lasts *over twice* as long as other belts!

Handling hot shakeout sand demands a belt that is really rugged. That is why a 355 ft. length of 30" x 7 ply Super-Insulated Sahara* is used for this gruelling sand reclaiming operation at this tractor foundry.

This belting thrives on heat and abrasion that kill off other belts 2 to 5 times faster . . . does a better job at far less cost to you.

Its special INNERLOCKED* construction of heavy-duty hard silver duck, long-fiber asbestos insulation, and exclusive impregnating compounds will give you maximum resistance to temperatures up to 600 degrees. Let Imperial solve your foundry needs. Time to start—Now.

Phone or write for complete information on how Imperial's Super-Insulated Sahara* can serve you better . . . cost you less.

Registered trademarks of Imperial Belting Co.

If you want this kind of service under rugged conditions like these

Just Order Imperial whenever the going's hot and heavy!

This new brochure will tell you all about Imperial Belting specially designed for foundry service

Send for your free copy today!

You expect MORE from Imperial . . . and you get MORE!

Imperial INNERLOCKED® **BELTING**

First in stitched canvas belting for over 50 years

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Imperial Belting Co.
1760 S. Kilbourn Ave., Chicago 23, Ill.

( ) I'd like a free belting survey of my plant

( ) Please send your catalog and engineering handbook.

Name_____

Company_____

Address_____

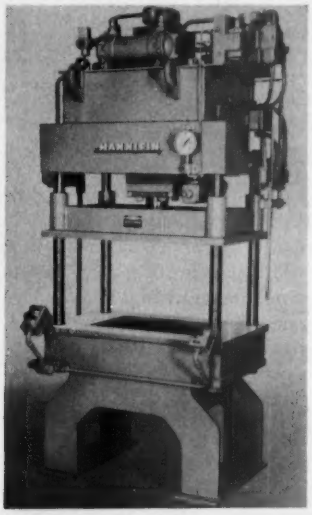
Circle 589 on Page 39

For More Information Use
Reader Service Card—Page 39

What's New in Equipment and Supplies

TRIMMING PRESS

Hydraulic trimming press of 30-ton capacity is available for trimming large castings. Unit has 1300-ipm ram speed, but this may be



reduced to 240 ipm at casting contact so that trimming can be done by a soft shearing action. Additional features include 20-in. stroke, 30-in. gap, working pressure of 2120 psi max, 20-hp motor, 31-gpm pump, and 29 × 42-in. base.—**Hannifin Co.**, Dept. 238, Des Plaines, Ill.

For More Details Circle No. 451—Page 39

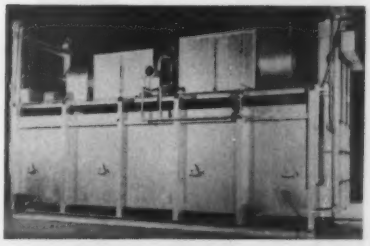
SHELL MOLD RELEASE

Calcium stearate dispersion is composed of 46 per cent solids in fine particle size plus special dispersing aids to assure good package stability. Mold release effect afforded by adding this dispersion to resin-bonded sand is said to reduce or eliminate need for silicone-type mold release agents. Improved surface characteristics and tensile strengths are claimed to result from better flow and denser packing of the sand when the dispersion is used.—**Harshaw Chemical Co.**, 1945 E. 97th St., Cleveland 6, Ohio.

For More Details Circle No. 452—Page 39

HEAT TREATING FURNACE

Heat treating furnace is for nodular iron castings. Safety feature is a valve cutoff device that shuts off the furnace if there is a loss of air or gas pressure or when either of the pilots goes out. Unit is of the recirculating type with two alloy fans which pull air from the furnace through a combustion cham-



ber and back into the furnace. Walls are of brick 13½ in. thick and contain the recirculating ducts. Shell is constructed of 3/16-in. sheet steel plus steel channels and I-beams. Doors are lined with lightweight refractory. They are counterweighted and are operated by timed hydraulic cylinders.—**Waltz Furnace Co.**, Dept. 29, 1901 Symmes St., Cincinnati, Ohio.

For More Details Circle No. 453—Page 39

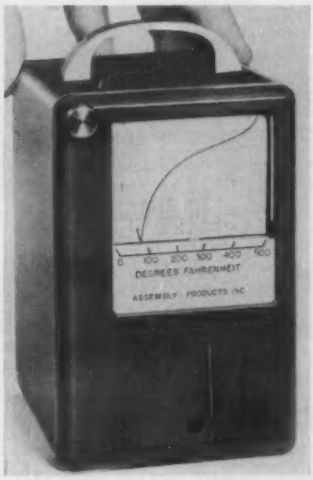
CARBON SAND

Carbon sand type of molding material is for use with bronze, aluminum, and some ferrous metals. Material consists of hard, solid, round-grain carbon particles and is not a pulverized material. It is said to provide low thermal expansion and good casting finish. It also is claimed to accelerate cooling, resist crushing, and have a permeability comparable to that of silica sand. Sieve analysis shows AFS fineness number of 65 for the sand, which weighs approximately 12 lb per gal.—**Humble Oil & Refining Co.**, Penola Div., 14300 McNichols Rd. West, Detroit 35, Mich.

For More Details Circle No. 454—Page 39

TEMPERATURE RECORDER

Miniature temperature recorder operates directly from a thermocouple without signal amplification. Only electrical connections are the thermocouple and a 115-v ac line. Minimum temperature span is 0 to



500° F, and maximum span is 0 to 2500° F. Accuracy is ±2 per cent of full scale, and chart speed is 1 in.

per hr, although other speeds are available. Unit is 3⅝ in. wide, 5⅜ in. high, and 4⅛ in. deep. Weight with paper roll is 3½ lb.—**Assembly Products Inc.**, Chesterland, Ohio.

For More Details Circle No. 455—Page 39

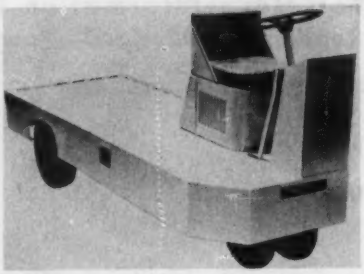
AIR VIBRATORS

Two new one-piece air vibrators are 1⅝ and 5-in. sizes with long-stroke, heavy duty pistons in the larger models. Cylinders are either steel or aluminum for lightweight applications. All units can be equipped with automatic lubrication and air filter units to stop impurities and moisture. They are installed directly on bins, chutes, and hoppers to maintain flow of all types of material from powder to heavy chunks.—**Cleveland Vibrator Co.**, 2828 Clinton Ave., Cleveland 13, Ohio.

For More Details Circle No. 456—Page 39

PLATFORM TRUCK

Platform truck with 4000-lb capacity is designated Model F-40A. Unit features three-element, single-stage torque converter; 4-wheel hydraulic brakes; dead-man seat; and 18-hp air-cooled engine with 12-v



starting. It is 42 in. wide with a 72-in. cargo area behind the operator. Space to right of engine enclosure is 21 in. wide by 122 in. long.—**Prime-Mover Co.**, Muscatine, Iowa.

For More Details Circle No. 457—Page 39

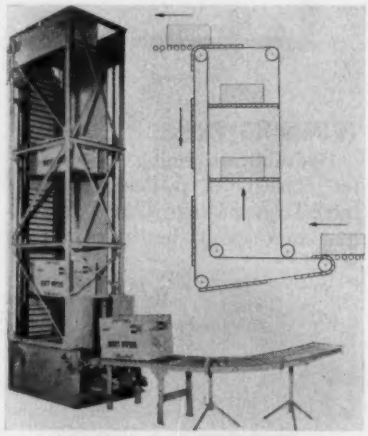
INTERCHANGEABLE CYLINDER

An interchangeable cylinder is offered for use without modification in air or hydraulic systems for all types of industrial applications at pressures up to 200 psi air and 500 psi oil or water. Series A cylinders are available in 21 different mounting styles and 11 bore sizes from 1½ through 14 in. with strokes to the user's specifications. Greater cylinder speed and power is provided by full area ports, available in alternate positions. Piston and cartridge-retained rod seals are rated for operation at −20 to 150° F.—**S-P Mfg. Corp.**, 30201 Aurora Rd., Cleveland 39, Ohio.

For More Details Circle No. 458—Page 39

VERTICAL CONVEYOR

Vertical conveyor, called Escaveyor, utilizes horizontal flights for carrying which fold automatically to assume a space-saving vertical position for the return trip. Unit is compact



and is said to require less floor than a straight lift conveyor. It can be used for up-service or down-service or can be made reversible. A range of capacities is available to suit various needs.—**Standard Conveyor Co.**, North St. Paul 9, Minn.

For More Details Circle No. 459—Page 39

GRAIN REFINER

Metallurgical compound was developed to reduce grain size and increase structural strength in aluminum alloy castings. Material is available in five grades for treatment of various alloys and is supplied as tablets or blocks. It is plunged to the bottom of a melt with a preheated perforated plunger.—**Foundry Services Inc.**, P. O. Box 8728, Cleveland 35, Ohio.

For More Details Circle No. 460—Page 39

ELECTRIC HOISTS

Low headroom type electric hoists have been added to the manufacturer's series 700 line. Capacities of the new units range from 2 to 6 tons. Options available are single or two-speed lift; push-type, hand geared; or motor-driven trolley suspensions; various lifts and speeds; and any standard three-phase elec-

Machine Shot Blasts Castings on Rotary Table

Line of rotary table shot blast machines consists of eight models with capacities ranging from 1000 to 8500 lb per hr. Table diameter varies from 2 ft, 6 in. to 10 ft. No foundation is required for units up to 4000 lb per hr capacity.

Impellers apply the shot to castings on the rotary table. From one to three impellers are used, depending on table size. Each impeller consists of two throwing blades fixed to a rotating disc. Shot is fed into an impeller near its axis and is thrown against the castings by centrifugal force. Blade replacement is said to be quick and easy.

Dust is extracted from the entire surface of the work table and filtered from the exhaust air in cloth filter units. A screening and sifting device sorts out return shot, which is handled by a bucket conveyor system with special elevator belt, steel buckets, and cast iron belt drums. Shot is stored in a bin incorporated on the conveyor casing above the work table.—**F. E. North America Ltd.**, 47 Advance Rd., Toronto 18, Ont., Canada.

For More Details Circle No. 482—Page 39

From ten-yard pipe to ten thousand valves Hevi-Duty matches the furnace to your requirements

Whether you process 30-ft castings or thousands of small parts . . . whether you use fuel-fired or electric heat . . . automatic or batch handling, the correct combination can be supplied by Hevi-Duty.

Hevi-Duty offers a wide selection of furnaces, each one carefully engineered to hold close tolerances . . . to turn out uniformly high-quality products day after day, year after year.

If you have a heat-processing problem, why not call in a Hevi-Duty sales engineer? We are almost certain he can help you, for he is much more than an order taker. He is a consultant— qualified to recommend entire heat-processing systems and backed by a company that can quickly adapt the equipment to fit your needs exactly.

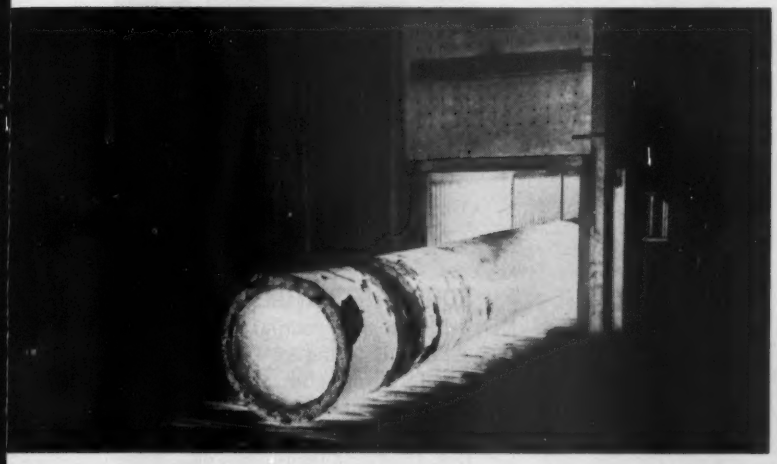
HEVI-DUTY

Electric and Fuel-Fired Industrial Furnaces and Ovens

B P C

A Division of Basic Products Corporation

Hevi-Duty Electric Company, Watertown, Wis.



◀ Sandusky Foundry and Machine Company, Sandusky, Ohio, uses this Hevi-Duty car-bottom furnace to heat-treat castings up to 54 inches in diameter and 30 feet in length. Heating elements located in both ends, and in the car bottom, plus three fans, produce a degree of temperature uniformity generally expected only in smaller units. **For complete information, write for Bulletin 644R.**

▲ Pacific Steel Casting Company, San Francisco, California, is pleased with the operation of this Hevi-Duty Clean-Line Furnace. It heats, holds at the correct temperature for the prescribed period, transfers each load to the cooling chamber, and discharges baskets of castings automatically. A retractor on the unload table enables the Clean-Line Furnace to process four baskets without manual handling or supervision. Heat-treated castings come out ready for shipping without further attention. **For complete information on this, write for Bulletin D-100A.**

▲ Eaton Manufacturing Company's Valve Division really proves the ability of Hevi-Duty pit furnaces to maintain uniformity. They process dense 2,000-lb charges of valves — 10,000 to a load — all free from distortion, all uniformly hard . . . no rejects. An efficient fan and baffle system provides an even rate of heating throughout the dense load and contributes to over-all uniformity. **For complete information, send for Bulletin 646A.**

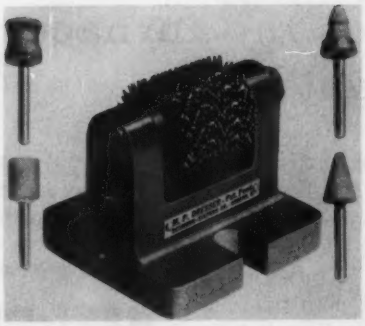
Circle 590 on Page 39

tric power. Features of each unit include steel suspension frame, large diameter drum and sheaves, helical load gearing, positive acting load brake, limit switch to prevent overtravel of the lower block, multiple disc motor brake, pendant control, and dual-wound motors.—**Manning, Maxwell & Moore Inc., Shaw-Box Crane & Hoist Div.**, Muskegon, Mich.

For More Details Circle No. 461—Page 39

WHEEL DRESSER

Grinding wheel dresser is designed to restore the shape of worn abrasive mounted points. The revolving mounted point is held against thin-gauge, star-type cutters for a few seconds until the original shape of the point is restored. Illustration shows how these points can



be restored. Mounting base is 3 × 3¼ in. and can be bolted or screwed to a bench.—**Desmond-Stephan Mfg. Co.**, Urbana, Ohio.

For More Details Circle No. 462—Page 39

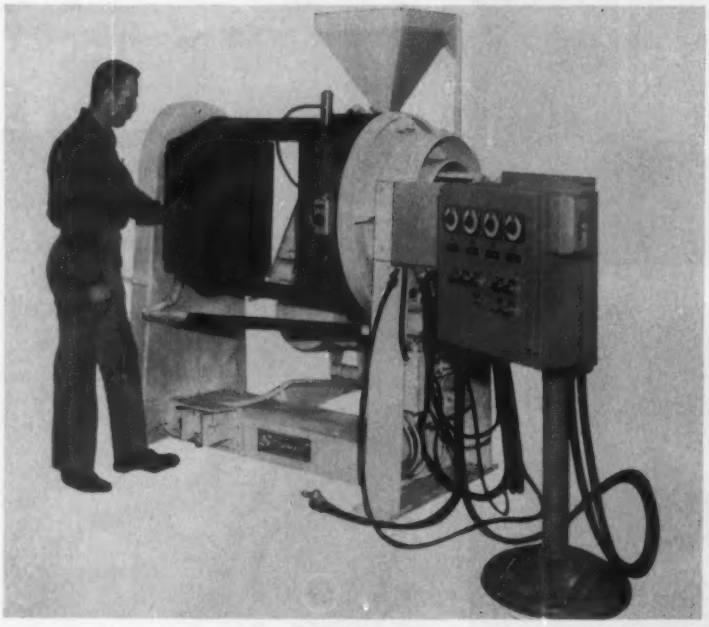
WELDING TOOLS

Welding torches can be used for both cutting and welding. Cutting is accomplished by increasing current density above good welding condition levels while utilizing argon-hydrogen shielding mixtures. Normal gas flow rates are sufficient to transfer energy across the arc and displace the molten metal. Simple scratch starting is employed, and arc length is not critical. Standard dc power equipment with 70-volt open circuit can be used to cut

metals in a range from ⅛ to ½ in. thick. Typical cutting speeds are 40-60 ipm on ⅛ in. aluminum and 20-40 ipm on ⅛ in. stainless steel.—**Linde Co.**, division of Union Carbide Corp., 270 Park Ave., New York 17, N. Y.

For More Details Circle No. 463—Page 39

Shell Core Machine Can Produce Large Cores



Automatic shell core machine Model SF10A was developed to produce large shell cores. Unit can accommodate coreboxes up to 30 in. high which weigh as much as 800 lb. Natural, manufactured, or bottled gas can be used in the direct gas-fired manifold to produce 210,000 Btu rated output. Sand magazine of 150-lb capacity travels on a specially constructed track and is clamped by a pneumatic-powered latch. Unit also is equipped with a 300-lb shell sand storage hopper with automatic feeding unit. Production rate of single-cavity cores is claimed to be 70 to 90 cores per hour. Controls for the unit are pneumatic and electric. —**Beardsley & Piper Div., Pettibone Mulliken Corp.**, 2424 N. Cicero Ave., Chicago 39, Ill.

For More Details Circle No. 483—Page 39

ROOF VENTILATORS

Plastic roof ventilators are available in 10 standard sizes from 400 cfm to 15,000 cfm. All-plastic construction enables ventilators to remove corrosive fumes from laboratories, anodizing operations, etc., without damage. Plastic impeller blows fumes high into the air above roofline.—**Heil Process Equipment Corp.**, 12850 Elmwood Ave., Cleveland 11, Ohio.

For More Details Circle No. 464—Page 39

SAFETY SHOE FLAP

New light plastic that reportedly withstands greater than normal impact forms the protective core of a flap covering the instep of Hy-Test safety shoes. It features a snug-fitting flap covering the arch, light enough to be flexible and claimed to be strong enough to withstand 25 ft-lb without injury to the foot. — **International Shoe Co.**, 1509 Washington Ave., St. Louis 66, Mo.

For More Details Circle No. 465—Page 39

VACUUM ARC FURNACE

Vacuum arc melting furnace is designed to recover titanium scrap but also can handle other reactive

14" x 17" Radiograph of clutch-cover casting made to inspect for shrinkage.

The grip that moves mountains must not be broken

Clutches on heavy earth-moving equipment must literally grip with a cast-steel hand. Riverside Foundry, Bettendorf, Iowa, checks the reliability of its clutch-cover castings with radiography.

One of Riverside Foundry's customers makes huge and powerful earth-moving vehicles. Every part must contribute to their stamina—especially the parts that handle the hundreds of horsepower that drive them.

In order to make sure that the castings they deliver are sound and ready for this demanding job, Riverside Foundry of Bettendorf, Iowa, radiographs them, using Kodak Industrial X-ray Film.

This is one of the ways foundries, large and small, are today making certain only high-quality work goes to their customers. They find radiography helps build their reputations and their business.

Radiography can work profitably for you. How? Talk it over with an x-ray dealer or write for a Kodak Technical Representative to call.

NOW . . .
in the NEW Ready Pack . . .
Kodak Industrial X-ray Film,
Type AA and Type M

- No darkroom loading—each sheet sealed in a light-tight envelope.
- Just place Ready Pack in position and expose—film protected from dust, dirt, light and moisture.
- In the darkroom—just pull the rip strip, remove film and process.

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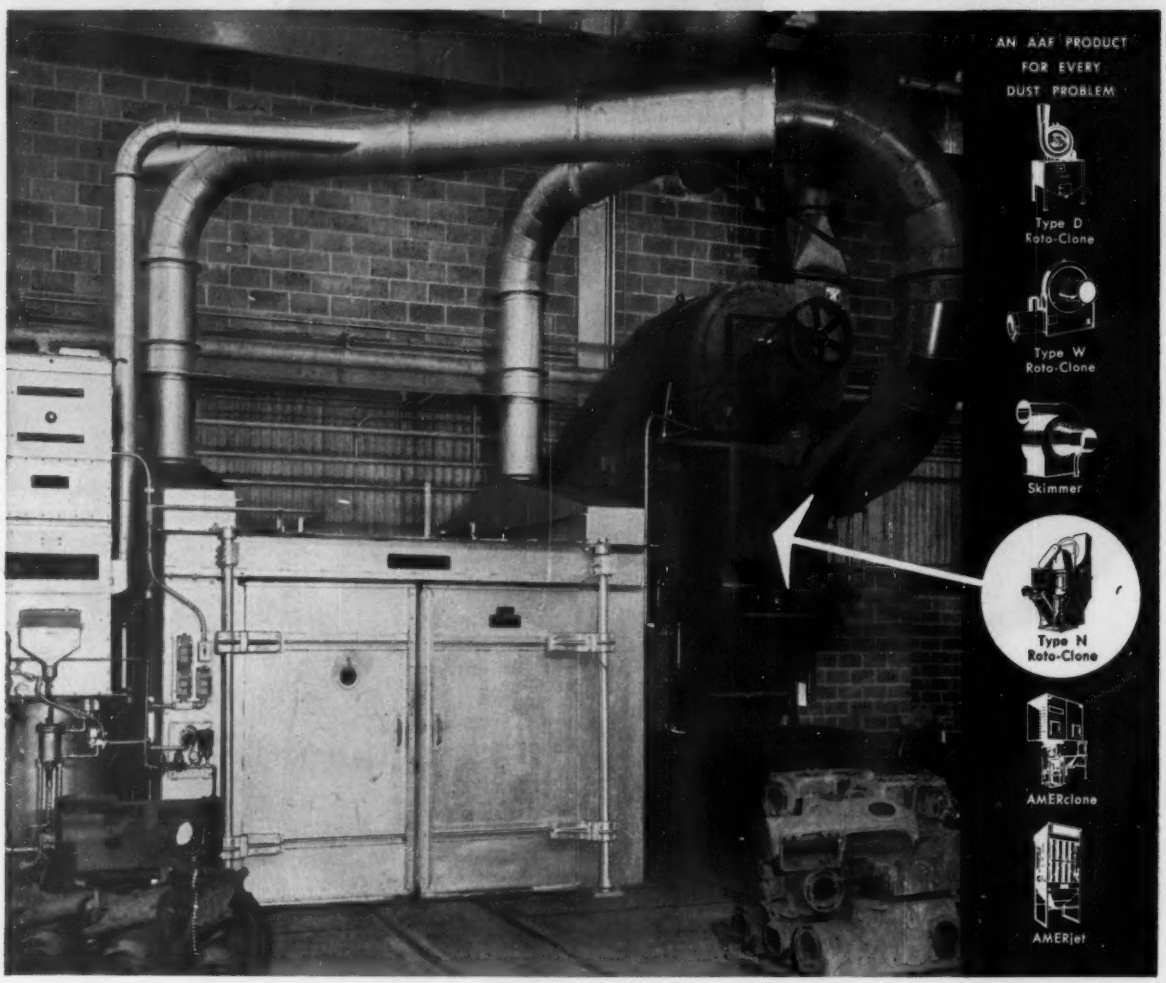
Circle 591 on Page 39

ABRASIVE CLEANING



AAF Type N ROTO-CLONE reduces dust to harmless sludge!

● The dust storms created in this abrasive cleaning operation never "get off the ground," because the AAF Type N ROTO-CLONE collects dust as fast as it is generated. Then, by hydro-static precipitation, the dust is quickly converted into a harmless, easily disposable sludge – preventing secondary dust problems.

This is only one of many applications in which the Type N is keeping dust "under wraps." Its high cleaning efficiency results from the combined action of centrifugal force and thorough intermixing of water and dust-laden air.

AAF's complete line of dust control equipment was application-developed, now challenges *any* foundry dust problem. If *your* problem is abrasive cleaning, contact your local AAF representative or write direct for Dust Control Bulletin 277. Address: Mr. Robert Moore, American Air Filter Co., Inc., 266 Central Avenue, Louisville, Kentucky.

AAF American Air Filter
BETTER AIR IS OUR BUSINESS

Circle 592 on Page 39

and refractory metals. Unit has a capacity of up to 800 lb and features helium gas cooling instead of water cooling, argon atmosphere during initial melting, charging unit to add material during melting, consumable arc melting under vacuum to remove dissolved gases, and skull melting by a permanent tungsten electrode. — **National Research Corp.**, 70 Memorial Drive, Cambridge 42, Mass.

For More Details Circle No. 466—Page 39

FINISHING TOOLS

Finishing tools are available in 4 to 12-in. wheel diameters for use on polishing lathes, rotary indexing machines, inline machines, and other equipment. Tools consist of straight wire cutting points encapsulated in a plastic bond. They are useful in removing flash from both aluminum and zinc diecast parts.—**Osborn Manufacturing Co.**, 5401 Hamilton Ave., Cleveland, Ohio.

For More Details Circle No. 467—Page 39

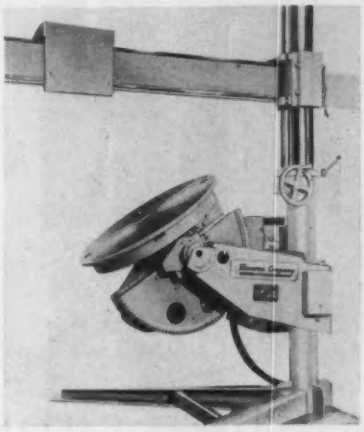
RELEASE AGENT

Release agent and mold lubricant offered in aerosol containers is for use with various materials such as metals, plastics, ceramics, acrylics, epoxies, and gypsum. Material is a dispersion of lubricating waxes with high adhesive qualities which permit it to remain on a surface through several cycles.—**British Industries Corp.**, Dept. L, 80 Shore Rd., Port Washington, N. Y.

For More Details Circle No. 468—Page 39

WELDING STATION

Welding station is composed of a 4 x 4-ft manipulator and a positioner capable of handling 2500 lb. Manipulator is elevated manually



for arc height adjustment by means of an Acme screw. The head support side-beam carriage is adjusted manually with a rack and pinion plus lock to cover the welding area handled by the positioner table. The positioner features variable speed drive, power-operated tilt, and remote operator's control station.—**Ransome Co.**, Scotch Plains, N. J.

For More Details Circle No. 469—Page 39

ACTUATOR

Air-operated actuator unit is designed to permit mounting of a limit switch where it can be protected from moisture, dirt, vibration, and heat. Unit is supplied air, at 40 to 80 psi, which is allowed to escape through a bleeder line to a bleeder orifice. Closing this bleeder orifice by any mechanical means allows air to build up pressure in the actuator, which in turn operates the limit switch.—**R. B. Denison Mfg. Co.**, 386 Broadway, Bedford, Ohio.

For More Details Circle No. 470—Page 39

MOTOR PROTECTOR

Miniature circuit breaker protects small motors in portable power tools and appliances. Unit attaches to the end of the cord and automatically cuts off power when the tool is overloaded. A button resets the circuit breaker, which is available at ratings from 3 to 10 amp.—**Modern Mfg. Co.**, 680 Davisville Rd., Willow Grove, Pa.

For More Details Circle No. 471—Page 39

MAGNETIC PARTICLE TESTERS

Portable magnetic particle testers are available for detecting defects at or near the surface of ferrous castings. Ferroflux Model weighs less

than 30 lb and can be positioned to magnetize in any direction. Unit operates on any 110-v ac line. Portaflux Model, shown in the photo, provides longitudinal and circular magnetization with coil and prod techniques. Aluminum case contains 600-amp ac generator and control within 17 x 12 x 8-in. dimensions and weighs 60 lb. Unit requires 10 amp from any 110-v ac line. Two 7-ft magnetizing cables are included.—**Picker X-ray Corp.**, 25 S. Broadway, White Plains, N. Y.

For More Details Circle No. 472—Page 39

CYLINDER MOUNTING

Power cylinder mounting is guaranteed not to shift, yet is said to permit fast installation. A flange plate fastened on a cylinder fits into a milled slot on the machine's mounting surface. The cylinder then is secured by means of a stand-

Unit Conditions Sand at 10 Tons per Hour

Portable sand conditioning unit Model 10F is designed for use in job shops and side floors of larger operations. Unit has detachable handles and semipneumatic tires to facilitate movement from one area to another. It weighs only 250 lb.

Rated capacity is 10 tons of sand per hour. Conditioning operations include separating refuse plus blending and cooling the sand. Refuse is separated by gravity, and the blending is accomplished by the churning action in the hopper. Cooling also results from the churning as well as from the open discharge

stream.—**Royer Foundry & Machine Co.**, Kingston, Pa.

For More Details Circle No. 484—Page 39

At Speakman Company...

OSBORN 716–

with automatic controls molds cope and drag simultaneously ...and in half the time

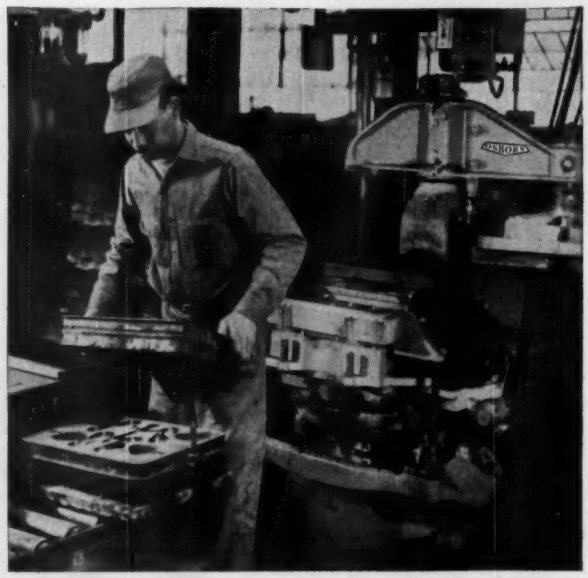
Osborn 716-PVA Automatic Vibrating Squeeze Pin Lift Molding Machine frees operator to set cores during machine molding cycle

Using the Osborn 716-PVA, a wide range of molds now produced with matchplate patterns can be made with even greater economy. Field reports show one man and the 716-PVA produce approximately twice as many molds per hour. The reports also show better quality finish on castings and less scrap. Operators also prefer the 716-PVA molding procedure because less manual effort is required. Here's why:

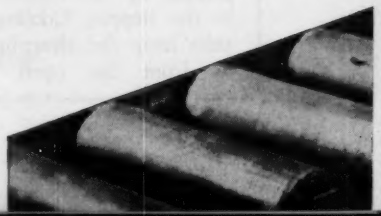
To simplify simultaneous cope and drag molding, the operator pushes a button, initiating the automatic molding cycle. During the cycle, in which both a cope and drag are produced at one time, the operator sets cores in a previously made drag.

As the 716-PVA completes its cycle, the cope and drag halves are stripped automatically and remain at rest on the lifting frame. The operator picks off the cope, places it over the cored drag of the previous cycle. After pushing the complete mold onto the conveyor, the operator removes the next drag from the PVA machine. Flasks are placed on the machine, the flasks are filled with sand and the next automatic molding cycle initiated.

A study of your operations could show savings like these in your molding department. Call *The Osborn Manufacturing Company, 5401 Hamilton Ave., Cleveland 14, Ohio.*

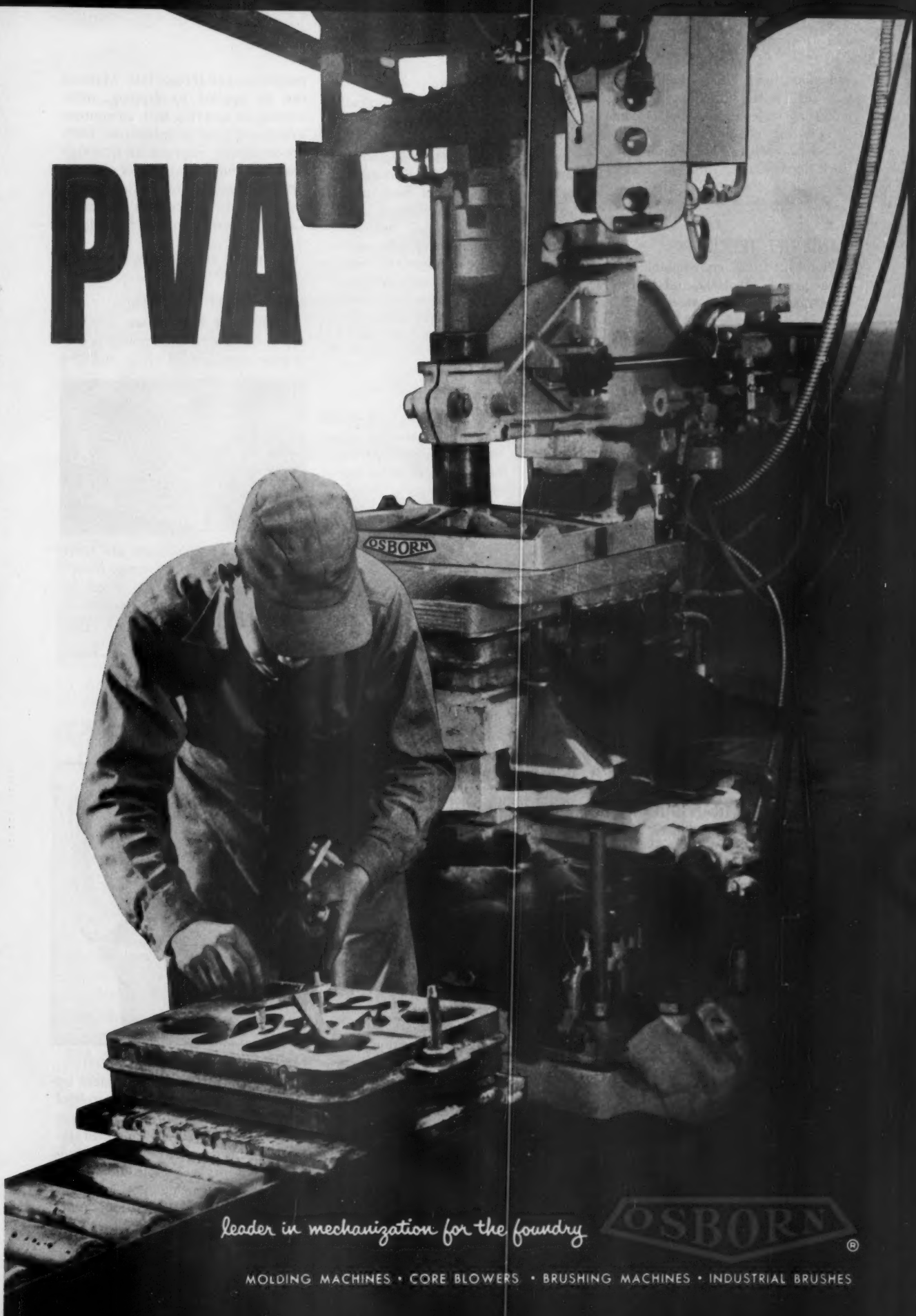


AT SPEAKMAN COMPANY, WILMINGTON, DELAWARE, *quality molds for brass plumbing fixtures are produced efficiently on preset time cycles with Osborn's automatic controlled 716-PVA Vibrating Squeeze Pin Lift Molding Machines.*



Circle 593 on Page 39

PVA



leader in mechanization for the foundry

OSBORN®

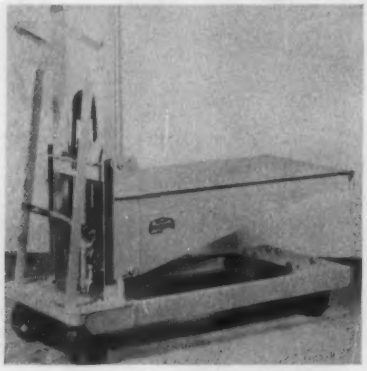
MOLDING MACHINES • CORE BLOWERS • BRUSHING MACHINES • INDUSTRIAL BRUSHES

ard mounting. Unit is available in side lug, flush side, and end lug mounting styles in all bores of company's line of air and hydraulic cylinders.—**Miller Fluid Power Div., Flick-Reedy Corp.**, York and Thorndale Roads, Bensenville, Ill.

For More Details Circle No. 473—Page 39

HAND LIFT TRUCKS

Hand lift trucks are available with capacities of 300, 1000, and 1500 lb. All three models are arc welded of

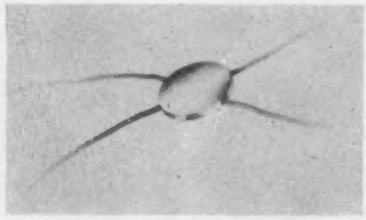


structural steel. Platform on the 300-lb capacity unit is operated by a hand winch featuring a load-actuated brake. The other models use foot-operated hydraulic lift units. Shown in the photo is the 1000-lb capacity unit. All models can be built to customer specifications.—**Port-A-Lift Co.**, 3680 East Schumann Rd., Bay City, Mich.

For More Details Circle No. 474—Page 39

STRAIN GAGE TRANSDUCER

Strain gage transducer Model P318 is a flush-diaphragm, absolute-pressure transducer featuring high-frequency response. Unit weighs 0.5 gram and is 0.59 in. in diameter by 0.05 in. thick. Ranges are 0-10 psi



to 0-100 psi, available in absolute, gage, or differential readings. Excitation is 15 v, and output is 5 mv, full scale open circuit. Ambient temperature limits are −65 to +150° F. —**Statham Instruments Inc.**, 12401 W. Olympic Blvd., Los Angeles 64, Calif.

For More Details Circle No. 475—Page 39

BELT SANDER

Belt sander can be used vertically or horizontally or in any position between. Hinged guard on the idler drum opens to expose a surface for sanding curved objects. Features include enclosed cabinet base, auxiliary work table, mitre gauge, sealed bearings, preloaded belt tensioner, and one-knob tracking adjustment with setting lock. Adjustable fence and dust collector are available. Unit is for use with wood, plastic, or metal.—**Duro Metal Products Co.**, 2651 N. Kildare Ave., Chicago, Ill.

For More Details Circle No. 476—Page 39

TRACTOR SHOVEL

Tractor shovel Model Y-18 features 6-ft dumping clearance with carrying capacity of 2500 lb. Standard bucket size is of 18-cu-ft capacity, and optional bucket sizes range from 12 to 31 cu ft. Bucket

design and 45-degree bucket tip back at ground level are said to give full capacity carries every time.—**Yale Materials Handling Div., Yale & Towne Mfg. Co.**, 11000 Roosevelt Blvd., Philadelphia 15, Pa.

For More Details Circle No. 477—Page 39

BLAST CLEANING ABRASIVE

Blast cleaning abrasive called Pangborn G is claimed to be a material as close to steel as possible to make in a cupola. It was developed to occupy a position, with respect to performance and cost, between malleable and steel abrasives. —**Pangborn Corp.**, Hagerstown, Md.

For More Details Circle No. 478—Page 39

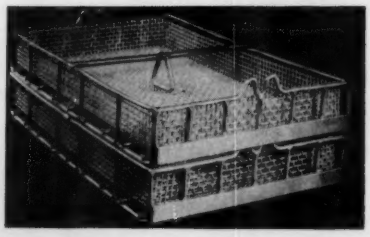
METAL COATING

Chemical surface-treating process coats all types of metals in a single treatment. Coating provides corrosion resistance and good weathering properties, and is color fast. Material can be applied by dipping, roller coating, or spraying with an aqueous solution at room temperatures. Only pre-treatment required is thorough cleaning and rinsing. Color coatings or clear coatings in various grades are available. — **Pennsalt Chemicals Corp.**, 3 Penn Center, Philadelphia 2, Pa.

For More Details Circle No. 479—Page 39

HEAT TREAT BASKETS

Heat treat baskets are designed for stacking without slipping. Standard sizes are 22 x 34 x 5 in. and 28 x

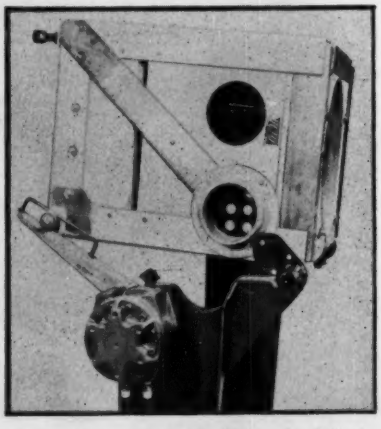


43 x 5 in. Special sizes are fabricated, and height can range from 2 to 9 in. Basket consists of an Inconel tray and woven mesh liner.—**Ipsen Industries Inc.**, 721 S. Main St., Rockford, Ill.

For More Details Circle No. 480—Page 39

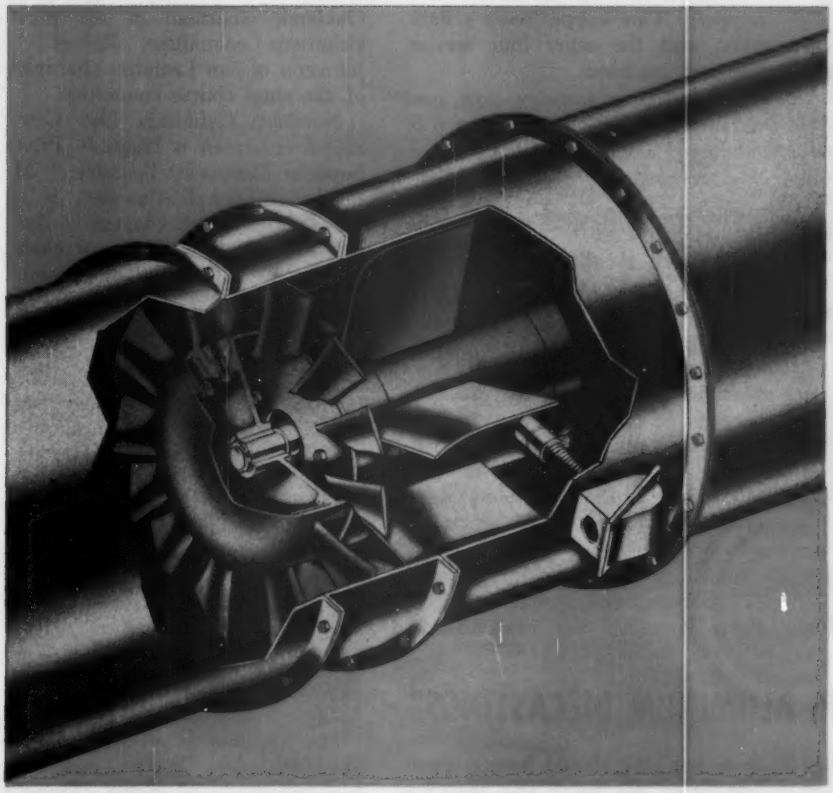
ROTARY FURNACE TILTER

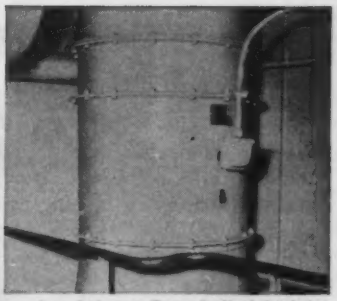
Hydraulically operated, rotary tilting mechanism is available for



use with company's line of tilting-type induction melting furnaces up to 2000-lb capacity. Control of pouring and uniformity of pour stream are advantages claimed for this pouring system. Mechanism is shown in the photo holding a furnace in pouring position.—**Inductotherm Corp.**, 412 Illinois Ave., Delanco, N. J.

For More Details Circle No. 481—Page 39





Joy Axivane Fans bolt right into the ductwork. This saves space and simplifies installation.

Joy Design Means:

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Joy Axivane® Fans are compact and easy to install because of the integral motor design. They can be bolted right into the duct, and will maintain the straight-through flow of the air. By eliminating the offsets and elbows necessary with other fans, Joy Axivane Fans improve over-all system efficiency. Installation costs are reduced, because the fans can be put in place as the duct is being fabricated, and there are no motor supports to construct.

The basic vaneaxial design of Joy fans makes them highly efficient, particularly where large volumes or high pressures are involved. All Joy Axivane Fans have adjustable blades. By changing blade pitch, fan output can be varied as much as $\pm 20\%$ without the loss of fan efficiency typical of dampers or variable inlet vane controls. When the system is difficult to calculate, or varies from time to time, this feature can save you a great deal of time and money.

For complete information on how Joy Axivane Fans can solve your ventilating problems, write for Bulletin 13-1213.

AIR MOVING EQUIPMENT FOR ALL INDUSTRY

JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

Circle 594 on Page 39

Darling Valve & Mfg. Doubles Capacity of Bronze Foundry

Darling Valve & Mfg. Co., Williamsport, Pa., has put a newly equipped bronze foundry into operation which has a melting capacity of 12,000 lb a day, or almost double the capacity of the old foundry.

Two Multiductor static frequency converters are used to operate four furnace shells. Two shells, with 500 and 600-lb capacities, are controlled by one converter, and the other controls another 600 and a 1000-lb capacity shell.

With this melting equipment the foundry can melt and pour 1600 lbs of bronze at one time. The system uses the same power to melt and stir the metal to assure production of homogeneous, noncontaminated melts.

A new sand handling system also has been installed. A bucket elevator with aerator and a conveyor belt distribution system services five hoppers. One hopper feeds a flask filler, and the other four service molding machines.

The Darling foundry now can handle up to 1000-lb castings. It produces a variety of valve and hydrant parts.

Committee Heads Named for AFS West Coast Congress

S. D. Russell, president, Phoenix Iron Works, Oakland, Calif., has been named chairman of the host chapter convention committee for the first Castings Congress and Exposition to be scheduled for the West Coast by the American Foundrymen's Society. The event is scheduled for next May 8-12.

Assisting Mr. Russell are Donald C. Caudron, vice president, Pacific Brass Foundry, San Francisco, as chairman of the hospitality committee; Charles R. Marshall, president, Industrial & Foundry Supply Co., Oakland, chairman of the plant visitations committee; Robert A. Johnston of San Leandro, chairman of the shop course committee.

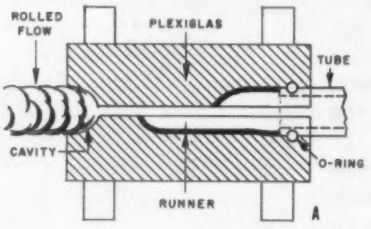
Northern California Day Committee chairman is Hugh F. Prior, Superior Electrocast Foundry. J. M. Snyder, National Abrasives, is in charge of publicity. Clayton D. Russell, Phoenix Iron Works, is chairman of the ladies' program committee.

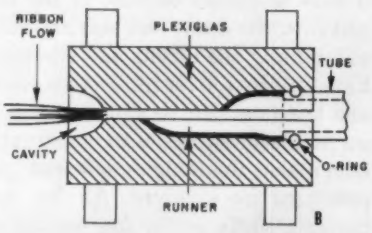
Chairman of the banquet committee is Lane M. Currie, executive vice president, H. C. Macaulay Foundry Co., Berkeley. Davis Taylor, 593 Market St., San Francisco, is chapter secretary.

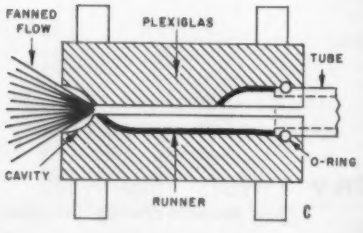
AN ERROR IN "GATING ALUMINUM DIECASTINGS"

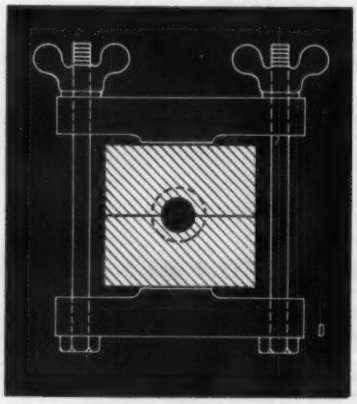
The editors regret an inadvertent error in Fig. 1 of "Gating Aluminum Diecastings" by Earle W. Rearwin, Reed-Prentice Div., Package Machinery Co., which appeared on pp. 106-113, FOUNDRY, November, 1960.

In A, B, and C of Fig. 1, the cross hatching should have stopped outside of the heavy line marking the runner system. In D of Fig. 1, the two blocks should have come together, and an opening should have been indicated. These various spaces mistakenly were filled in. A corrected version is shown here.









Steel Founders' President To Open Centennial Year

Centennial year activities for the Steel Founders' Society of America will be opened by Wilson H. Moriarty when he delivers a Newcomen Address in Philadelphia on Jan. 19.

Mr. Moriarty is president of the Steel Founders' Society and first vice president and group executive of the National Malleable & Steel Castings Co., Cleveland. He will trace the history and growth of the steel castings industry in the United States at the Benjamin Franklin birthday dinner of the Newcomen Society of North America.

The Newcomen Society, founded to advance the history of engineering and technology, selected the Steel Founders' Society as guest because of contributions to American industrial progress made by the steel castings industry since it began in 1861 in Buffalo. The national centennial observance is under the direction of the SFSA.

Chicago Foundrymen Elect

Chicago Foundrymen's Association has re-elected John K. Hodgson as president. He is secretary of Hodgson Foundry Co. Other officers are B. J. Chelini Jr., Troy Brass & Aluminum Foundry Inc., vice president; Harry J. Leddy, Joliet Foundry Div., Infilco Inc., Joliet, Ill., secretary-treasurer, and Mildred Kosar, who is executive secretary.

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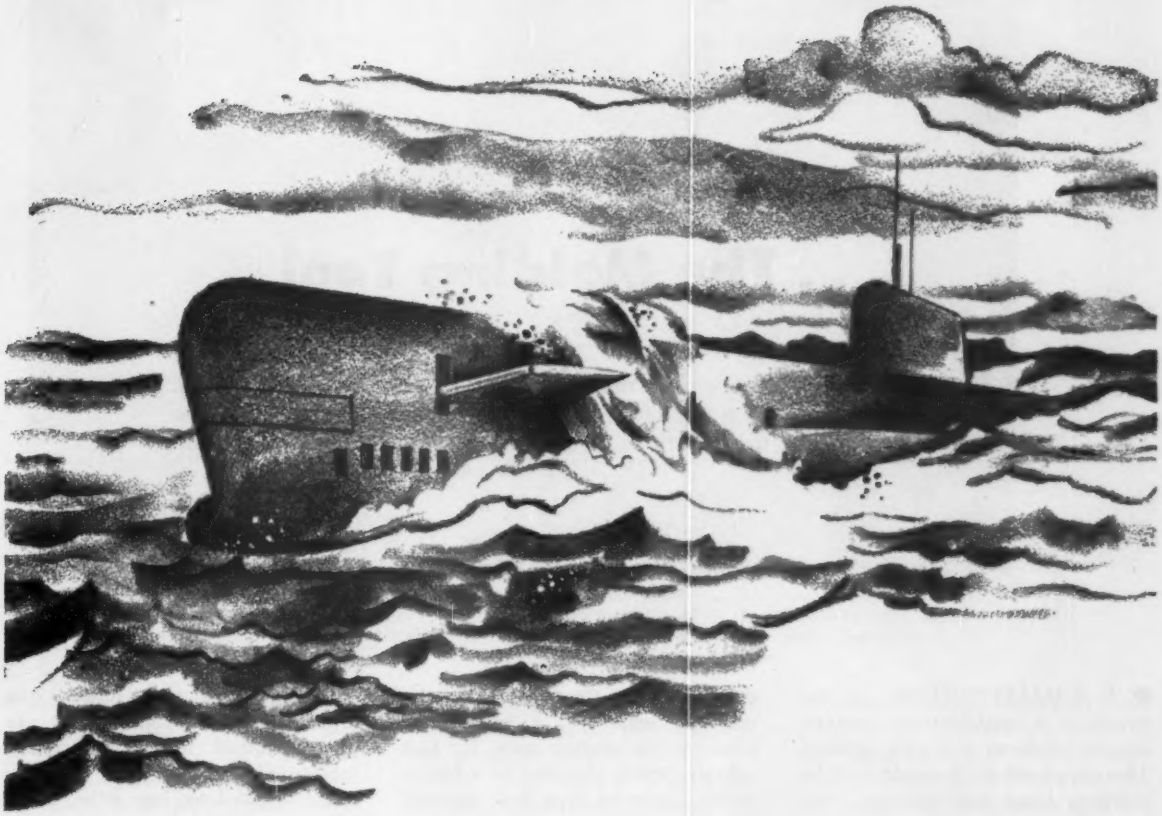

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Circle 595 on Page 39

SAND

. . . The Molding Tool

Each ferrous and nonferrous metal requires different molding sand. The author discusses types of sand for each metal and explains how to prepare them in this third of a series of six articles on sand

By W. P. WINTER
Assistant Professor
Pennsylvania State University
and
Sand Consultant, Royer Foundry & Machine Co.

● A QUALITY TOOL in the hands of a conscientious operator usually produces a quality product. This statement is obviously true for common hand and machine tools in use by experienced mechanics.

Selection of the best tool for the job, its preparation, and care are key factors. The training and experience of the operator also is important. The best end product will result if the tool is selected for quality and used with respect.

Molding sand—sand substance with binder and additive materials as needed—should be thought of and recognized as a tool. It can be a quality tool or a cheap, inadequate, falsely economic substitute. It can be properly used by a conscientious operator or ruined by improper preparation and care. In the final analysis the end product—the casting—is the important thing. Good sound castings are the only end products that the modern foundryman wants. Competition has become so keen that every care must be exercised toward getting and keeping that quality tool as well as the conscientious operator.

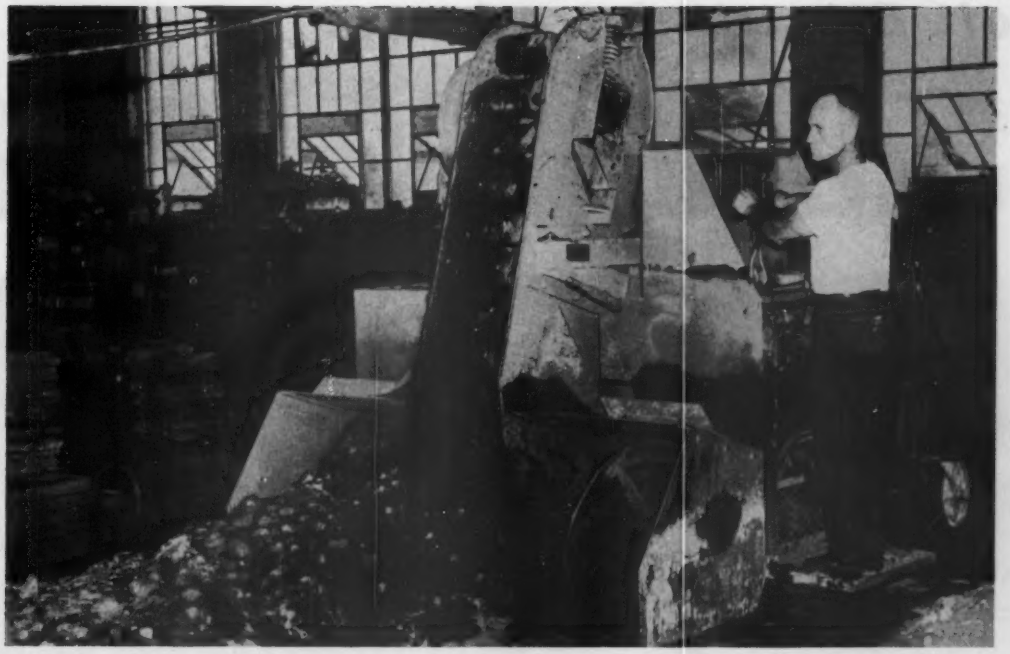
Molding Sand Classes—Sand substance alone, as discussed previously, is not especially useful for molding purposes. Some means must be provided to bond the individual grains together so that the resulting mass will withstand the forces to be exerted upon it. This cohesiveness is provided by a binder which varies in type and amount. Many molding sands contain other materials added for special reasons. Among the reasons for these additives are improved surface finish, reduced cleaning time, increased refractory quality, and improved workability of the sand mixture.

The simplest and often the least expensive molding sands are those that have proved to be useful as nature provided them. These are called *natural molding sands* since they need only controlled amounts of water to render them suitable for use. Natural molding sands rely on a natural clay bond and frequently contain no other additive. Natural molding sands exhibit conditions different than other types of molding sand. Since they are used as mined, they often contain substantial amounts of organic matter classed as impurities. Such impurities lower the refractoriness, which manifests itself as a lower sintering point.

Natural molding sands vary greatly from source to source and may contain as little as 5 per cent or as much as 20 per cent clay substance. Along with this wide variation in clay content, the presence of impurities and the nature of the clay substance necessitates the use of 5 to 9 per cent moisture. This is much more temper water than usually is required in other types of prepared molding sands. The decision to use a natural molding sand often hinges on such factors as type of metal being poured, size

MOLDING SAND COMPONENTS

Sand Substance	+	Binder	+	Facing Additive	+	Other Additives	+	Water
Silica		Natural clay		Seacoal		Wood flour		
Zircon		Fireclay		Graphite		Perlite		
Olivine		Bentonites		Pitch		Gilsonite		
Carbon		Cereal				Cellulose		
Chamotte		Oils				Fly ash		
Mullite		Resins				Silica flour		
						Fuel oil		
						Cereal hulls		
						Iron oxide		
						Alumina flour		



Preparation is as important to good performance of molding sand as the choice of proper ingredients. Thorough mixing and aerating are required for best results

and section thickness of castings, or the economics of supply and preparation.

When washed and graded sand substance is carefully mixed with selected clay or other binder in predetermined amounts, the mixture commonly is referred to as *synthetic molding sand*. It must be noted that the term is not entirely satisfactory since the sand is not chemically synthesized. The term is used because the mixture is artificial. There are times when a given foundry may have started with a natural sand but after repeated use it was found to need bond additions to restore strength. The result is no longer a true natural molding sand and it cannot be called a true synthetic molding sand.

In other instances a natural sand with limited amounts of clay may be strengthened with clay additions before it is used. Foundrymen have coined the term *semi-synthetic molding sand* to distinguish this type of molding sand. To some the difference may seem academic and they prefer to think only of two major classifications.

In general, synthetic molding sands provide greatly improved properties and easier control. Initial cost may be somewhat higher, but in the long range their use tends to be more economical. The control factor is eased since organic and inorganic impurities are not present. This helps to reduce the amount of clay needed to bond the sand effectively, and reduced clay substance allows for reduction of temper water.

Synthetic molding sands often require only 3 to 7 per cent clay and as little as 3 to 5 per cent moisture. This low moisture is an important advantage since it reduces moisture-related problems all along the line. In some instances foundrymen claim that synthetic sands lose water more rapidly and thus create manipulation problems. It is more nearly correct to say that the loss of water is essentially constant but the synthetic sand has less water to lose and hence appears to dry more quickly. Any problems that appear to be created by this condition are best solved by selecting a better mixture.

Selection of Molding Sands—Unfortunately, there is a general lack of data to aid the foundryman in the selection of the best possible molding sand. The basic problem is to determine the sand best suited to specific foundry conditions. The logical approach would be to base the selection on exact data determined experimentally by scientific methods. Common terms are not fully and properly defined, however, and there are those who feel that present testing methods do not supply usable comprehensive data.

Until new test methods are devised and shown to be superior, or until enough specific data are recorded on which to base a selection, foundrymen will find it necessary to apply those tests that are available. These include tests for green and hot strength, permeability, deformation, sintering point, grain fineness, distribution and others. If it is recognized that these tests are interrelated, some reasonably reliable molding sand evaluations will result.

Steel Sands—Since steel usually is poured at temperatures considerably higher than those for most other common metallic alloys, the refractory quality of the molding sand used must be higher. This fact tends to favor the use of reasonably pure silica sand or other high-refractory sand substance, mixed with carefully selected high-quality clays, and moisture added to determined control limits. One or another of the special additives may be necessary in some cases. This is a typical synthetic molding sand application.

The sand substance usually is

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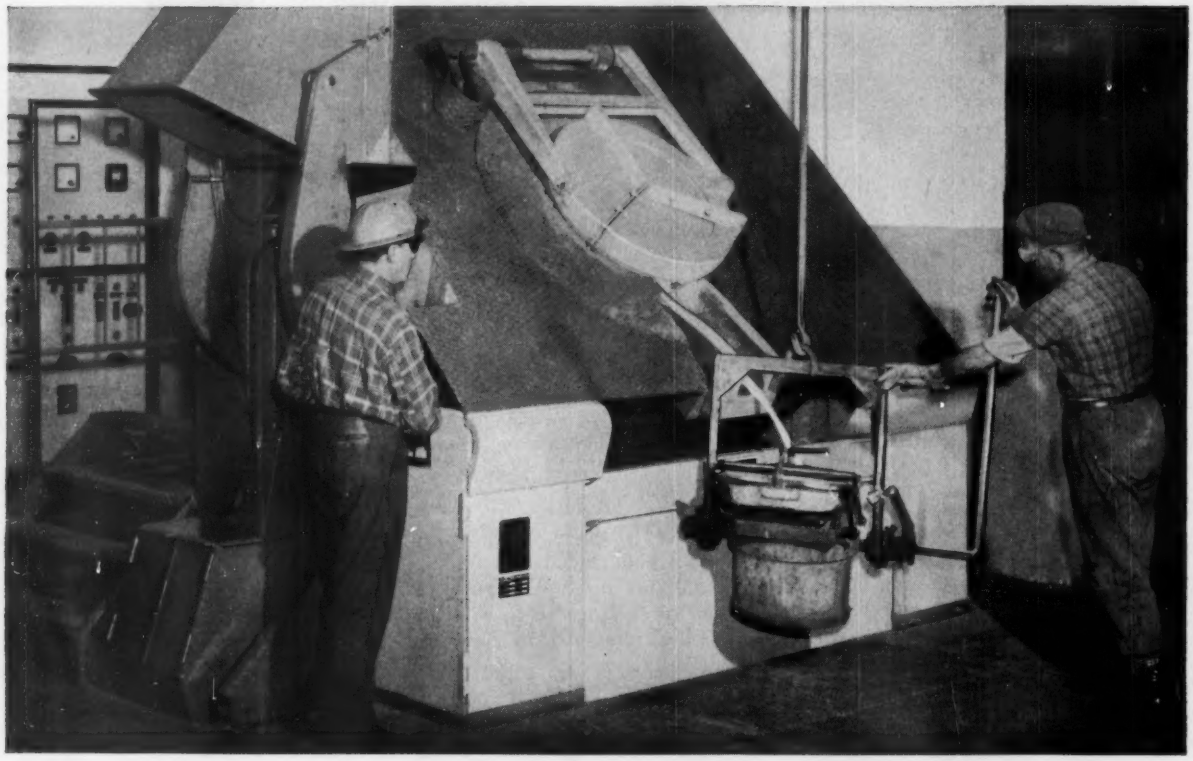
2 NEW 60 CYCLE



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FASTER MELTS: electromagnetic stirring, thorough mixing and uniform heat throughout the bath.

HIGHER QUALITY: exceptionally clean melts with minimum contamination and metal loss.

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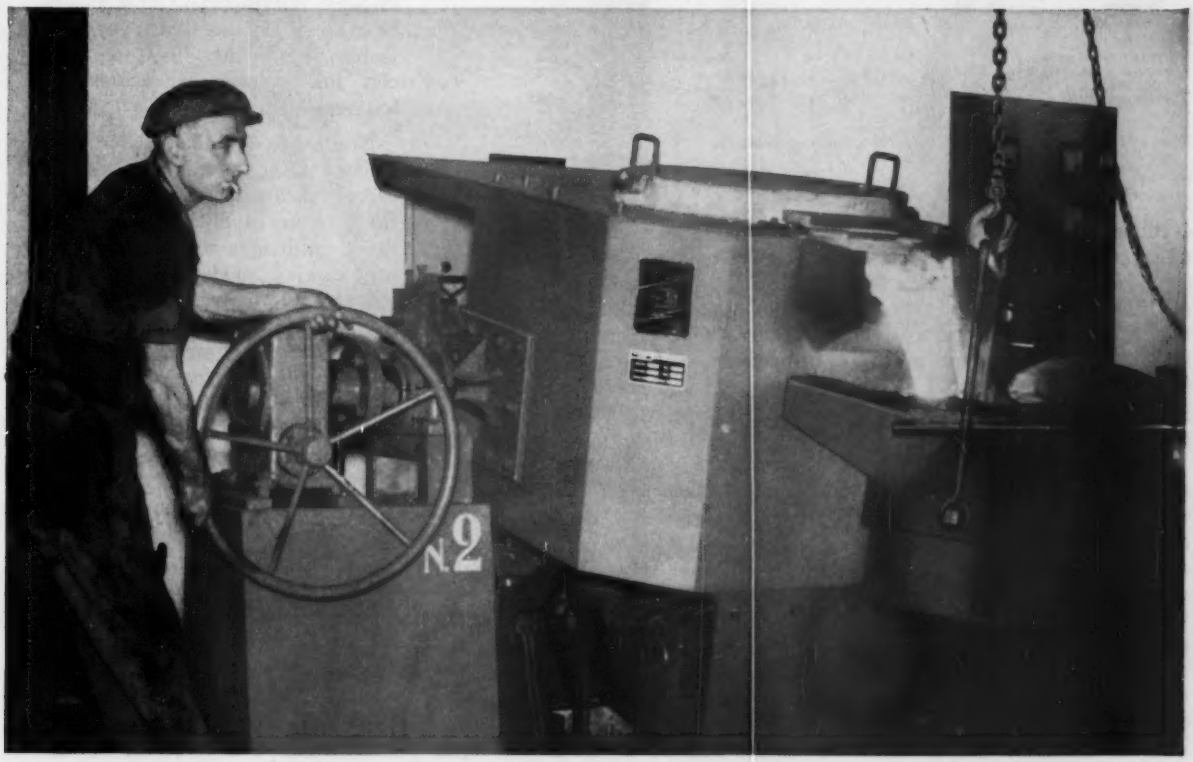

Detroit Crescenzi ABI Core Type

BETTER CONTROL: continuous stirring action, homogenous mixing, low oxidation, natural degassing, guaranteed pure, clean melts.

OPERATING ADVANTAGES: continuous melting, ready supply of molten metal for intermittent pouring and additions, simpler control for easier handling.

TOP ECONOMY: simpler construction, low metal loss and power consumption, less initial cost and lower operating costs.

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Circle 596 on Page 39

TABLE I—Typical Synthetic Sand Mixtures for Steel

	Green Sand			Skin-Dried Sand		
	Bench Work	Medium No. 1	Medium No. 2	No. 1	No. 2	Dry Sand
SAND SUBSTANCE						
AFS fineness 60 to 80	475 lb	475 lb	45 lb	1400 lb	500 lb	500 lb
Reclaimed system sand			600 lb		500 lb	
Silica flour						50 lb
BINDERS						
Western bentonite	25 lb	25 lb	10 lb	28 lb	20 lb	15 lb
Plastic fireclay				80 lb		20 lb
ADDITIVES						
Cereal	5 lb	7.5 lb	2 lb		10 lb	2 lb
Dextrine			2.5 lb			2 lb
Molasses				1 gal		
MOISTURE	3.5%	3.0-3.5%	4.0%		4.5%	5 gal
PROPERTIES						
Green compression, psi	6-6.5	6	6-8		6-8	
Green shear, psi				1.8-2.1		
Dry shear, psi				40		
Permeability	40	70-90	150		180	

Based on **Foundry Sand Practice** by C. A. Sanders, American Colloid Co.

evaluated in terms of sand grain shape, size, and distribution. The clay is selected on the basis of green and retained strength and other factors. Since molding sand that one steel foundry finds best may not be suitable in another steel foundry, it is impossible to be more specific regarding details.

The exact use to which the molding sand mixture will be put also should be considered. Small steel castings made in bench molds or small jolt-squeeze machine work usually require a sand of somewhat different character than the medium-heavy and heavy work accomplished with sandslingers. The first may be a green sand application and the larger work may be skin-dry or dry sand applications utilizing different types and amounts of binder. Table I shows some typical molding sand mixtures for general use in steel work. Such a tabulation can be misleading since sand substances vary from locality to locality. This tabulation must be considered merely as a simplified study of some typical synthetic molding sand mixtures.

Gray Iron Sands—Natural molding sands are more readily applicable to cast iron work because the higher refractory value may not be important. Natural bonded sands seem to be best when the work being done requires the finer grain sizes. Very light iron castings, requiring high density sand for surface finish control, are an example. The clay content likely will not exceed approximately 15 per cent, and readily available clays or new molding sand can be used for rebonding periodically.

Iron foundrymen gradually are finding it economical to use synthetic molding sands, however, especially when high-quality, close-dimension work is being done. This is true to a greater degree in the mechanized operations than it is for hand and short-run experimental work. As synthetic molding sand mixtures become more popular in iron foundry applications, it must be realized that a synthetic sand designed for steel will not necessarily do as good a job when used for iron.

Malleable Iron Sands—A molding sand designed for the production of gray iron castings, by the same token, cannot necessarily be used for the production of malleable iron castings. This is due to the fact that the latter material, cast as white iron, is more readily subject to hot tears and cracks. The high dry and hot strength of bentonite-bonded synthetic sands, desirable for many classes of gray iron work, are too strong for malleable iron work.

Table II is a simplified tabulation of some of the molding sands designed for gray iron and malleable iron work. Again it is important to recognize the mixtures as generalizations to be considered "typical" and not specific. Variations to suit individual needs and to suit the sand substance most economically available are necessary to apply a given mixture to a foundry. An important note should be made of the fact that many malleable foundrymen insist on fireclay instead of either western or southern bentonite.

Nonferrous Sands—It is possible to class all of the nonferrous alloys except magnesium in one group for the purpose of discussing molding sands. Although fine-grained natural molding sands are highly satisfactory, the newest trend for nonferrous work is utilization of a semi-synthetic molding sand. This means that the foundry may start with any one of the acceptable grades of natural bonded sand and control conditions by adding selected clay. In those foundries where the proper degree of mechanization exists, the practice leans toward fully synthetic molding sands. Lack of machinery for proper preparation of the molding sand has been the biggest single deterrent to using synthetic sands.

Regardless of natural, semi-synthetic, or synthetic sand practice, the casting of most of the nonferrous alloys requires molding sand of rather fine-grained character and with a medium to low clay content. These general properties have been obtained over the years by using the well known Albany sands. Many foundries have been able to

TABLE II—Typical Synthetic Sand Mixtures for Iron

	Gray Iron					Malleable Iron		
	Green Sand			Skin-Dried	Dry Sand	Green Sand		
	Light	Medium	Heavy			Light	Medium	Heavy
SAND SUBSTANCE								
AFS fineness 90 to 160	100 lb					96 lb		
AFS fineness 50 to 60		50 lb	40 lb	40 lb	20 lb		96 lb	50 lb
Reclaimed or system sand		50	60	60	60			50
Bank sand (AFS 90 to 140)					20			
BINDERS								
Western bentonite	4.5 lb	2.5 lb	2 lb	2 lb	3 lb	2 lb	2 lb	1.5 lb
Southern bentonite						2	2	1.5
Plastic fireclay					3			
ADDITIVES								
Gilsonite				1 lb				
Pitch			1 lb		2 lb			
Wood flour	1 lb	0.5 lb						
Seacoal	3	4	2			4	5	0.5
MOISTURE (% by wt)	3-3.5	3-3.5	4.5	3.5	7	3-3.5	3-3.5	3.3-3.5
PROPERTIES								
Green compression, psi	6-7	5.5-6	5	9-9.5	8.5-10	5-7	6-7	7-8
Permeability	30-40	90	120	120	100-120	20-40	80-90	90-110

Based on **Foundry Sand Practice** by C. A. Sanders, American Colloid Co.

Which of these three Arcair carbon electrodes is best for your Arcair torch?

Any one of the three. They're all sold by your Arcair dealer. Pick the electrode that works best for your particular application.

1. Standard Electrode in sizes from 5/32" to 3/4", copper clad.

2. Jointed Electrode practically eliminates stub loss. It's tapered on one end, has a hole in the other. By joining one electrode to the next, stub loss is eliminated. Sizes 1/2" to 3/4".

3. Electrode with metal joiner tube cuts down waste, too. Get the same results more economically. Sizes 3/8" to 3/4".

You're wise to buy only *Arcair* electrodes. They withstand higher amperages, finish more pounds of metal per minute. And Arcair electrodes are less fragile, can take the rough handling of foundry work with less breakage.

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Circle 597 on Page 39

use local sand deposits which they found provided similar properties. Rebonding with additions of new sand rather than with clay additions is quite common, but both methods are equally suitable if proper care in the selection of materials is exercised.

Of all the nonferrous alloys, magnesium alloy castings generally present the most formidable problems of molding sand selection. Moisture must be lower and grains fine enough to produce proper finish. The green compression strength should be approximately 6 to 10 psi. In addition, special additives are required to inhibit the action of water vapor on the hot metal. These additives include sulfur, borax, diethylene glycol, and some others.

The bonding clay used may not be adversely affected by these chemical additives. Western bentonite, although usually too high in hot compression strength, seems to react favorably with them in molding sands for casting magnesium alloys. This favorable reaction provides the proper hot compression strength without extensively affecting other properties.

Sand Preparation—Quality materials, like a quality tool, without proper preparation may promote poor end results. Many sand casting defects can be traced to faulty sand preparation. The fundamental need is for molding sand in which the grains are coated uniformly with bond but no excess bond retained in the grain interstices. This will give the fullest utilization of the bond and maximum permeability and workability. Molding sand preparation may be accomplished in batches of a size commensurate with the equipment in use or it may be accomplished as a continuous supply. Careful measurement, thorough mixing, proper tempering, and aeration are all required.

The instructions given to the operator often specify some materials by the shovelful. Such methods of measuring are so highly inaccurate as to be useless. The most reliable specifications should give the weight of each ingredient to be used. Where weighing is impractical, a measuring device that permits accurate volumes should be used.

In larger batches the 100-lb sacks that many materials are shipped in provide a good unit, but for smaller batches a quart measure that can be leveled might be used, or a special measuring can made to specifications might be useful. It should be of a size most suitable for the quantities needed and just large enough so that level filling is accomplished easily. Careful measuring will pay dividends in the long run.

First, the measured materials should be mixed dry or nearly so. Several different types of devices are manufactured, all of which are highly suitable for this step. In pan type mullers, wheel-like rollers knead the sand while plows turn it over and over under the rollers. As soon as this mixing has progressed sufficiently, a portion of the temper water is added and mulling continued. After a period of additional mulling the balance of the temper water is added and mulling completed. Since mulling time can be important and will vary with different sands and clays, no attempt can be made to suggest duration of total mulling time. Pug mills and conveyor-roller mulling also are used in some installations. In pug mills the slowly rotating blades mix the materials and provide a slight amount of this kneading. In some pug mills muller wheels are included. Both the pug mill and the conveyor-roller type of mixing are more common in continuous operations.

Foundrymen used the principle of aeration, in the form of hand riddles, long before mechanical devices were designed and built. Riddling removes tramp iron and other solid particles, breaks up clusters or lumps of molding sand, and renders the sand more workable. This improved workability is due largely to aeration of the sand and in modern devices is accomplished by mechanical screening, combing, or throwing actions.

Many foundries have solved their problem with aerating equipment that combines combing of the sand with churning, mixing, and cooling.

Some modern equipment will move into the sand heap, scoop up, completely condition and discharge 40 to 60 tons of sand an hour. Complete conditioning includes magnetic separation of all ferrous scrap as well as elimination of other refuse.

"Hey, Sneed . . . . Is that new Super really as tough as they say he . . . . Oh, forgit it."

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Circle 598 on Page 39

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The Simplicity model "VS" conveyor shown moves hot sand from two shakeouts, up a three degree incline, to an elevator at an average rate of 80 tons, with a peak load of one hundred twenty tons per hour. As the sand moves along the conveyor deck, water is added and plows turn the sand thus reducing the sand temperature one hundred degrees. The sand is discharged from the conveyor into the elevator boot over a permanent magnet which removes all of the metal particles.

Simplicity conveyors have proved efficient for transferring materials such as sand and castings, from one point to another. Feed points can be positioned along the length of the conveyor, and materials transferred to a common discharge point.

"VS" conveyors are available in widths from 12" to 36" and in lengths from 10' to 60' with one drive assembly. At customer request, these conveyors can be equipped with liners, covers, or can be built in two surface units.

Write for catalog C-1 which describes the various models of Simplicity Conveyors.

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224

Circle 601 on Page 39

Industry Briefs

Hardinge Mfg. Co., York, Pa., has completed a $300,000 foundry modernization and expansion program started in January, 1960. The Hardinge foundry now has a floor area of 32,000 sq ft and a nominal capacity of 250 tons per month, which can be increased with additional personnel. Improvements include a new wing, a motive sandslinger, an enlarged cupola charging floor, new core ovens, a new muller, and automatic sand handling and storage.

Ulster Foundry & Machine Corp., 3 S. Madison Ave., Spring Valley, N. Y., has been incorporated to operate as an iron and steel foundry. Papers were filed by Sidney Schwartz, of the same address.

Eutectic Welding Alloys Corp., Flushing, N. Y., plans to construct a $2½ million metallurgical plant and research center next year to produce rods and electrodes from virgin metal to finished product in its own facilities. The center will include a foundry for melting and pouring ferrous and nonferrous alloys, and also for the development of new alloy systems.

Enid Foundry & Machine Shop, Enid, Okla., suffered losses estimated at $100,000 when fire gutted the two-story portion of the shop, which covers a city block, and a one-story wing of the structure.

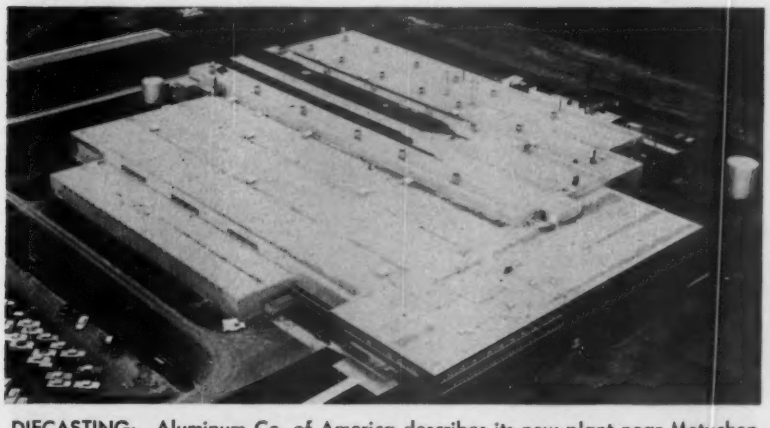
FOUNDRY Index Is Ready

Index to FOUNDRY, Volume 88, listing by title, subject matter, and author the editorial material published during 1960, is ready.

Readers find the index a handy reference to various phases of foundry practice, new techniques, and recent developments in the industry and a quick means of locating information published during the year.

Copies may be obtained without charge by directing requests to FOUNDRY, Penton Building, Cleveland 13, Ohio.

Arcair of Canada Ltd., 805 Davenport Rd., Toronto, has been formed to serve as sales and distribution headquarters in Canada for Arcair torches and electrodes. President of the newly formed company is Myron Stepath. Don Fraser is field sales representative, and Mrs. Ruth Flauder is office manager.



DIECASTING: Aluminum Co. of America describes its new plant near Metuchen, N. J., as the world's most modern aluminum diecasting plant. It will also produce permanent mold castings when additional facilities are installed next spring. The 260,000-sq-ft manufacturing area adjoins a two-story administration building. The new plant will supplant Alcoa's Garwood, N. J., and Bridgeport, Conn., plants, both of which will cease production this year

Dow Chemical Co., Midland, Mich., plans to close the diecasting department of its plant located at 801 Andre St., Bay City, Mich. The termination will withdraw Dow from competition with other diecasters who are its customers for magnesium diecasting ingot. A $400,000 customer service laboratory for diecasters established by Dow's magnesium sales department and located in Midland, is scheduled to open in January. The foundry and fabrication departments of the Bay City plant will remain in operation.

Drott Mfg. Corp., Milwaukee, manufacturers of front end loaders and mobile cranes, has purchased Travelift & Engineering Inc., Sturgeon Bay, Wis., manufacturer of mobile straddle carriers, for a sum reportedly in excess of $1 million. George Baudhuin, president of Travelift, will remain with the company as general manager of the new division.

Magnaflux Corp., Chicago, a wholly owned subsidiary of General Mills, has acquired Metal Control Laboratories, Los Angeles, which will be operated as part of the Magnaflux organization. Jonmore Dickason, who served as vice president of Metal Control Laboratories, will continue in the management of the firm's business activities.

Sunbeam Equipment Corp., Meadville, Pa., has appointed two new representatives of the Sunbeam line of industrial heat processing furnace equipment. They are Andrew T. Lobel, 1700 15th St., Denver, Colo., for Colorado, New Mexico, and Wyoming; and W. E. Swanson Co., 15320 Indian Creek Parkway, Brookfield, Wis., for Wisconsin, Minnesota, northeastern Iowa, and northwestern Illinois.

Hanson Machinery Co., Tiffin, Ohio, has purchased Hanson Clutch & Machinery Co. The new company will continue to manu-

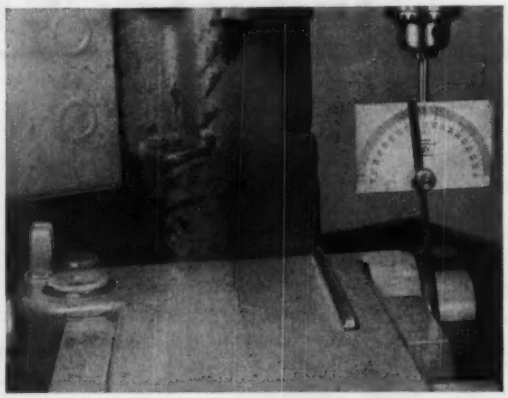
HOW To Do It

FOUNDRY will pay a minimum of $15 for each "How To Do It" idea submitted and published

Protractor Mounted on Drill Press Aids Inspection of Draft Angles

By H. J. GERBER
Assistant Professor
Metalworking Technology
Oklahoma State University
Stillwater, Okla.

QUICK, accurate measurement of draft angles on patterns and coreboxes is possible with this easily made device held in a drill press chuck. A round shank, made from a piece of drill rod, is soft-soldered to the back of a protractor. The shank must be perfectly square with the base line edge of the protractor. Squareness can be assured by clamping the protractor in approximate position and checking it with a precision square before soldering.



The work is laid directly on the drill press table and moved to various positions to be checked. The checking device is particularly useful for narrow recesses and other areas ordinarily difficult to measure.

facture the Hanson line of crawler and truck mounted excavators and cranes, and yard and dock cranes. C. O. Hanson, former president of Hanson Clutch & Machinery Co., has retired.

Vince Bruce Inc. is the new name of the Bruce & Conreaux Co., 5345 Lexington Ave., Indianapolis. The company name was changed because Gene Conreaux has resigned as secretary-treasurer and is no longer a member of this organization.

Ampco Metal Inc., Milwaukee, has licensed St. Paul Brass Foundry Co., 954 W. Minnehaha, St. Paul, to distribute castings of Ampco copper-base alloys in the Twin Cities area.

Selas Corp. of America, Dresher, Pa., has moved its Cleveland district headquarters to 6025 Mayfield Rd., Cleveland 24. This district is headed by T. G. Thurston. Telephone number is Hillcrest 2-6655.

General Communication Co., Boston, U. S. licensers of the Parlanti mold process, has licensed Swedish Crucible Steel Co., 8801 Conant Ave., Detroit 11, Mich., to use the process in its foundry for the production of steel castings.

Wisconsin Foundry Conference Scheduled for Feb. 9-10

Program for the annual Regional Foundry Conference sponsored by the Wisconsin Chapter, AFS, includes 21 technical papers plus two luncheon sessions and a conference banquet.

The meeting will be held at Hotel Schroeder, Milwaukee, Feb. 9-10.

Sectional meetings during the two days will cover subjects devoted to gray iron, steel, malleable, nonferrous metals, and patterns.

A pre-conference feature will be a visit on Wednesday, Feb. 8, to the Milwaukee plant of Evinrude Motors Div. of Outboard Marine Corp. The assembly plant will be toured in the morning and the foundry in the afternoon.

Details of the program are listed below:

Thursday, Feb. 9

9 a.m.—Registration
10 a.m.—Opening addresses: **The New Emphasis on Materials Research,** Associate Dean W. R. Marshall Jr., University of Wisconsin; **A Look at the Future for AFS,** Hilliard M. Patton, American Hoist & Derrick Co., St. Paul, and regional vice president of the AFS.
10:50 a.m.—General Meeting: **New Market Opportunities for Metal Castings,** Jack H. Schaum, editor, Modern Castings.
12 Noon—Luncheon: **You Make the Difference,** Bill Gove, president, The Bill Gove Organization.
2:15 p.m.—Sectional Meetings.
Gray Iron: **Heat Treatment of Cast Iron,** Marvin Evans, consulting metallurgist.
Steel: **Aircraft Quality—What and How,** John Varga, Battelle Memorial Institute, Columbus, Ohio.
Malleable Iron: **Core Sand Practice for the Malleable Iron Foundry,** Donald Dalton, Thiem Products Inc., Milwaukee.
Nonferrous: **New Air Set Cores and Practices,** Frank H. Dettore, G. E. Smith Co., Pittsburgh.
Pattern: **New Developments in Plastic and Plaster,** Stan Munson, Ren Plastics Inc., Lansing, Mich.
3:45 p.m.—Sectional Meetings.
Gray Iron: **Emission Analysis,** Allan Goldblatt, Applied Research Corp.
Steel: **What's New in Pyrometry?,** Douglas Johnson, Barber Coleman Co., Rockford, Ill.
Malleable Iron: **Molding in a Semi-Mechanized Foundry,** Carl Schopp, Link-Belt Co., Indianapolis.
Nonferrous: **What a Foundry Can Expect with a Plastic Core Binder,** Raymond Handwerk, B. F. Goodrich Co., Akron, Ohio.
Pattern: **Heated Corebox Equipment—What It Means to the Pattern Shop,** H. R. Bliter, International Harvester Co., Chicago.
6:30 p.m.—Banquet: **The Impact of Space Technology on the American Economy,** Dr. Joseph Shea, A C Spark Plug Div.

Friday, Feb. 10

10 a.m.—Sectional Meetings.
Gray Iron: **Reliability as It Pertains to the Foundry,** C. E. Drury, Central Foundry Div., General Motors Corp., Saginaw, Mich.
Steel: **Machinability of Steel Castings,** Edward J. Wellauer, Falk Corp., Milwaukee.
Malleable Iron: **Induction Melting of Malleable Iron,** Charles F. Smith, I. F. Mfg. Co., New Philadelphia, Ohio.
Nonferrous: **Producing Quality Castings,** A. B. Steck, Wehr Steel Co., Milwaukee.
Pattern: **The Advancement of Hot Coreboxes and Processes and What Is Ahead for the Soaring 1960's,** Ray Sutter, Sutter Products Co., Holly, Mich.
12 Noon—Luncheon: **Football, Professional Style,** Gary Knafelc, All-American End, Green Bay Packers.
2:30 p.m.—Sectional Meetings.
Gray Iron: **Pneumatic Chip Injection by the Roxy Process,** George W. Anselman, Anselman Foundry Services, St. Charles, Ill.
Steel: **Recent Innovations in Steel Molding,** Prof. R. W. Heine, University of Wisconsin and Lester B. Knight, Lester B. Knight & Associates, Chicago.
Malleable Iron: **Use of Exothermics on Malleable Iron,** Jack W. Gliddens, Foundry Services Inc., Berea, Ohio.
Nonferrous: **What's New in Light Metals?,** C. R. Howie, Aluminum Corp. of America, Pittsburgh.
Pattern: **Improved Methods for Cast-to-Size Patterns—Shaw Process,** R. J. Christensen, Wisconsin Pattern Works Inc., Racine, Wis.

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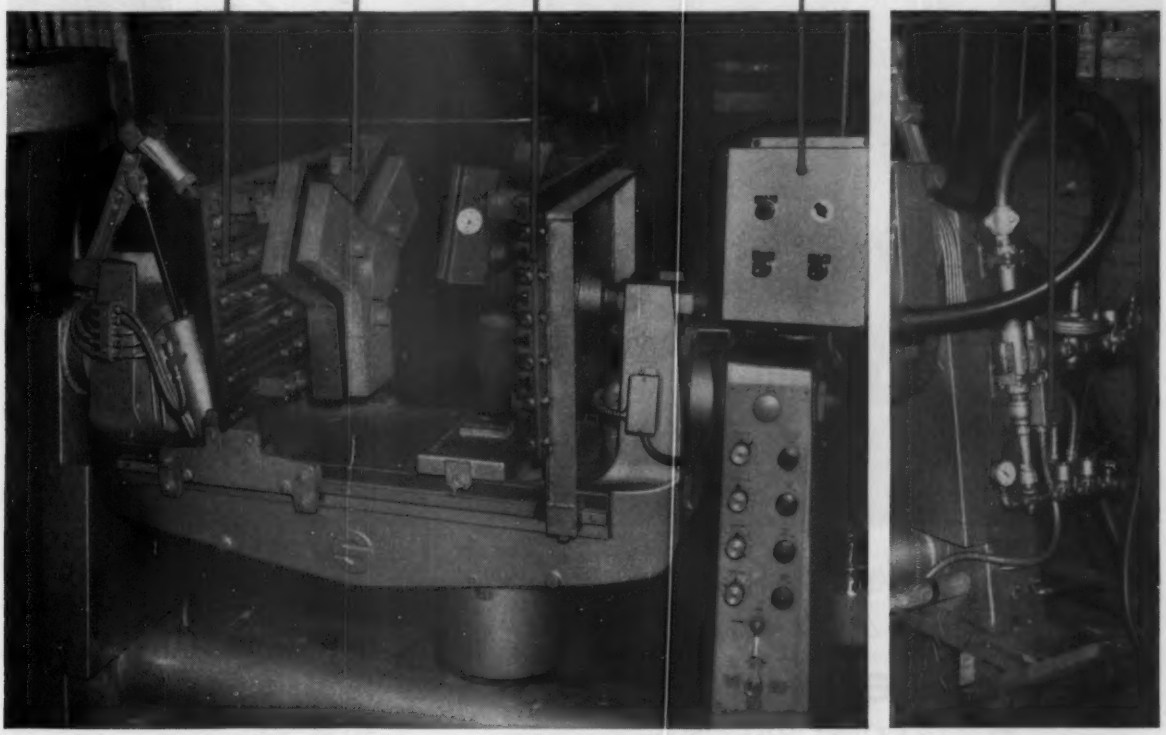

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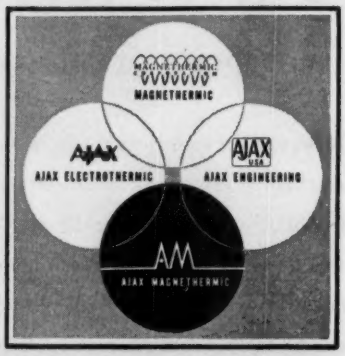

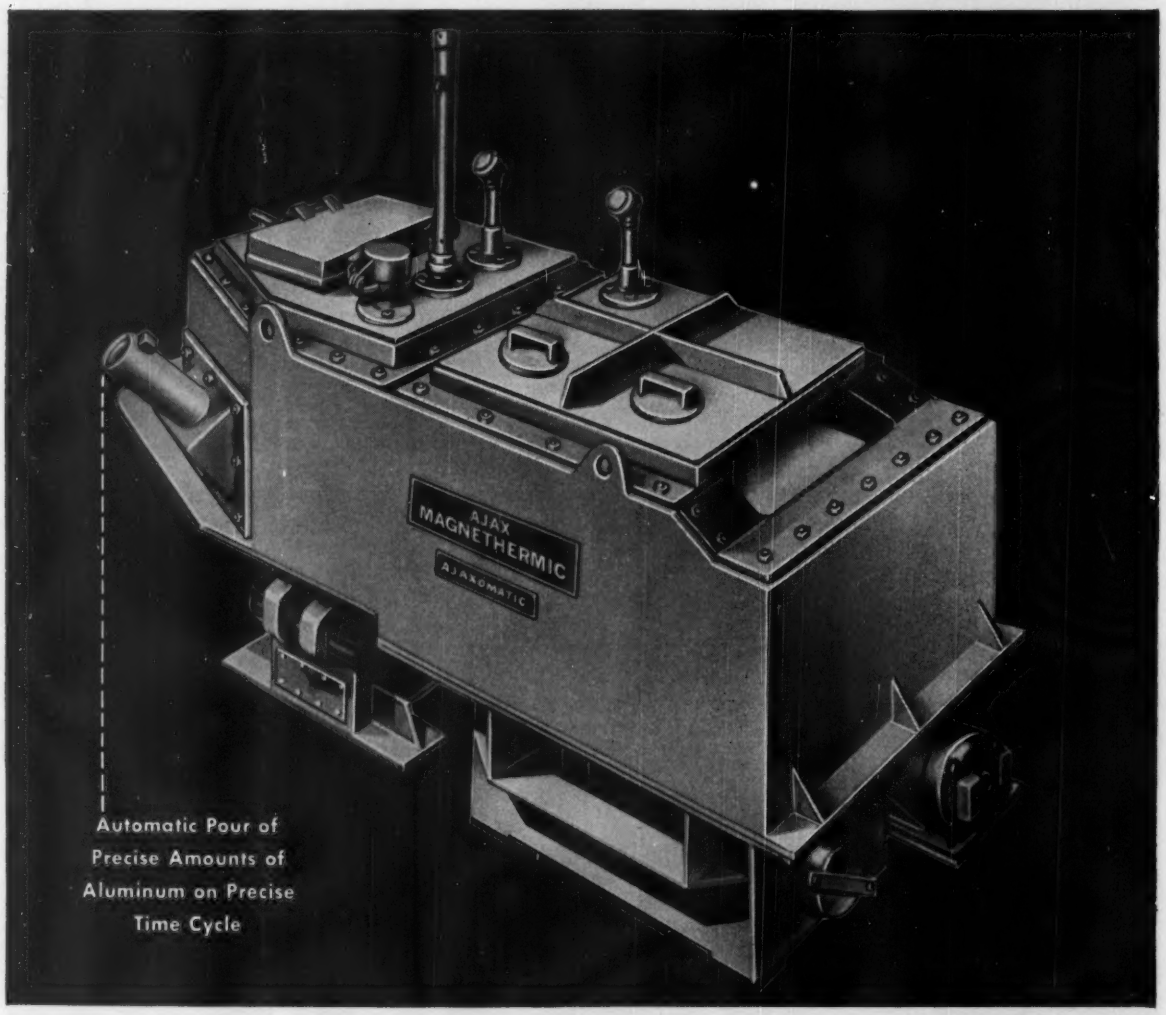

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Circle 599 on Page 39

By ROBERT H. HERRMANN
Associate Editor

Investment Founders See

Sales Increase for 1961

● OPTIMISM prevailed at the eighth annual meeting of the Investment Casting Institute held Nov. 1-3 at North Park Hotel, Chicago. Sales of investment cast parts in 1961 are expected to be 10 to 15 per cent above an anticipated $87 million for 1960. Sales in 1961 may be between $95 and $100 million.

The forecast was made by Nobi Takahashi, Forward Research Inc., Chicago, who conducted several surveys for the ICI in 1960. The surveys were conducted among 21 investment casting foundries. Survey statistics indicate that the investment casting industry is expanding more than other industries.

A separate ICI study shows that most interest in the use of investment cast parts is from the electronics and transportation industries as defined by Standard Industrial Classifications of the U. S. Department of Commerce. The two groups account for 57.8 per cent of the inquiries, with the electronics industry only slightly higher than the transportation industry.

Sales of investment castings for commercial applications are growing faster than sales for military and other defense uses. If that trend is to be accelerated, attention will have to be directed to problems of the industry uncovered by Mr. Takahashi's study. In order of importance given them, they are:

Inconsistent price quoting practices, buyers' and designers' lack of knowledge about investment castings, a need to reduce production costs, a need for more commercial business, lack of standards for investment castings, overselling of the capabilities of the investment casting process, a need for better raw materials, a lack of technical data exchange, and insufficient know-how.

The current group of officers were elected for a second term. They are: President—J. H. Morison, Hitchiner Mfg. Co., Milford, N. H.; vice president-management section—R. E. Gray, Gray-Syracuse Inc., Manlius, N. Y.; vice president-technical section—R. F. Waindle, WaiMet Alloys Co., Dearborn, Mich., and treasurer—L. R. Schwedes, Lawrence Laboratory, Santa Monica, Calif. Harry P. Dolan continues as executive director.

An Investment Casting Clinic was held prior to the technical and business sessions. It was attended by over 60 designers and buyers of castings. They heard a special report on "Castings and Investment Castings" and participated in workshop sessions on the following subjects: New Approach to Metal Forming, Machining vs. Investment Castings, Designing for Lowest Cost, Economics of Tooling, and New Developments in Investment Casting Alloys.

They also participated in a discussion of investment casting problems.

The technical session was opened by Mr. Waindle, program chairman, who told of the reorganization of institute technical activities under two main divisions of metal specifications and research.

C. A. Crawford, ICI technical director, told of 15 research projects now underway in the fields of structures and properties, gating and risering, melting practice, investment materials, and testing and inspection.

Because of the success of the ceramics course sponsored by ICI last year at Alfred University, Alfred, N. Y., another study group is being planned for presentation at another university this year. Additional design clinics also are being planned.

Technical papers dealt mainly with the heat treatment of castings, plus talks on welding, abrasive finishing, and co-operative research. First of five papers on heat treatment was **Ways and Means of Heat Treatment Applicable to Investment Castings**, by F. K. Iverson, Cannon Muskegon Corp., Muskegon, Mich. A general lack of information exists on how to heat treat for desired properties in investment castings. Consequently, that type of casting often possesses less than optimum properties attainable from proper treatment.

Optimum properties seldom can be achieved by a heat treatment intended for wrought materials. Often, however, heat treatments for other types of castings are satisfactory for investment cast parts.

Equipment and Control of Heat Treating for Ferrous and Nonferrous Castings, by H. F. Coyle, Leeds & Northrup Co., Philadelphia. Two prime requirements are necessary for good heat treating results: Good heat distribution in the furnace and proper temperature control. Proper procedures of furnace operation and loading were discussed. The function of a temperature control system is to replace heat lost from the furnace. To do that, the heat input must be varied either by on-off or proportioning systems. The temperature with on-off systems constantly fluctuates around the control range. Proportioning systems maintain the desired temperature.

The various furnace atmospheres and their function with relation to the numerous heat treating processes, including normalizing, hardening, carbon restoration, controlled surface carburization, and tempering were discussed.

Heat Treatment, Decarburization

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and Carbon Restoration in Low Alloy Steels, by R. V. Novy, Lindberg Engineering Co., Chicago. The precision aspect of investment castings should be carried beyond the casting operation to the heat treating process. Precision equipment and process technology are needed to do that.

An atmosphere generator for furnishing the desired gas to a heat treating furnace was described. Protective atmospheres have an important function in the heat treatment of castings, and their use will increase.

A comment was made during the discussion period to the effect that high alloy and stainless steels often are damaged more by a furnace atmosphere than by absence of a special atmosphere.

Problems of In-Plant Heat Treating, by E. M. Broad, Hitchiner Mfg. Co., Milford, N. H. The speaker's firm does its own heat treating because of problems encountered with outside heat treating firms, most of which have limited experience with the treatment of small parts in small quantities. But, because all types of treatment can not be performed in the foundry, some work must be sent outside for treatment.

Advantages of in-plant treatment are closer control of quality, shorter processing time, better scheduling of work, and avoidance of divided responsibility for treatment quality. Disadvantages are high equipment and maintenance costs, the need to hire workers experienced in heat treatment work, loss of production during equipment breakdowns, and problems with government control.

Working with the Outside Heat Treatment Firm, by W. A. Dubovick, Engineered Precision Casting Co., Matawan, N. J. Several experiences, good and bad, with outside heat treatment firms were described.

W. P. James, Wai-Met Alloys Co., Dearborn, Mich., joined the five speakers on heat treatment to form a panel to discuss questions from the audience. A discussion on the heat treatment of aluminum alloy 356 brought forth the following outline for obtaining satisfactory results: Use a furnace designed for the loads being treated, control the temperature to ±5° F but preferably hold it near the high side of the range, and quench the castings rapidly.

On the matter of decarburization, members of the panel pointed out that it is caused by heat concentration and is aggravated by casting section size. Less decarburization is encountered with investment castings produced in ceramic shell molds.

Industry Growth Through Co-operative Research, was discussed by Mr. James in the absence of Jack Keverian, General Electric Co., Schenectady, N. Y., who is in charge of the co-operative research program. Subjects suggested for researching by participating companies are: Effect of superheat on alloys, cast structures and their properties, effect of variations in composition of alloys, impact properties of investment cast steels, development of standard terminology for casting defects, and development of radiographic standards for castings.

More people are needed to participate in these projects and on committees handling the projects.

Current Developments in Welding Investment Castings, by John Flannery, International Nickel Co., New York. The small size of most investment castings often makes welding difficult if not impossible. Often scrapping a casting and making another is cheaper than trying to weld the defective part.

Various welding methods, welding alloys, and their use were discussed. Metal structure before welding, after welding, and after welding and heat treatment was shown.

Abrasive Finishing of Castings, by J. K. McLaughlin, Behr-Manning Div., Norton Co., Troy, N. Y. He described briefly the new diamond-coated abrasive belts that are expensive but will do jobs that other belts can not do.

Belts with aluminum oxide coatings for use on ferrous metals and silicon carbide coated belts for nonferrous metals were discussed. Belts now are operated at slower speed (5000-6500 sfm) than was the practice a few years ago (10,000-12,000 sfm) to give the abrasive an opportunity to cut satisfactorily.

Operations for which belts can be used were described. They are not recommended for use on materials above Rc 55 hardness. Wheels are recommended for such materials. Also tumbling and blast cleaning are satisfactory for some applications.

Circle 603 on Page 39→

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Ohio Ferro-Alloys Corporation
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Foundry Developments

By EDWIN BREMER

Metallurgical Editor

Fatigue Studies

APPLICATION of high - frequency ultrasonic attenuation and velocity measurements to investigate physical changes in aluminum and other metals during stress cycling are described in a research report PB 161487 which may be obtained from the Office of Technical Services, U. S. Department of Commerce, Washington 25. Title is "The Use of Ultrasonic Methods To Determine Fatigue Effects in Metals," and the price is 75 cents.

Replaces Some Coke

TESTS conducted by the Bureau of Mines in an experimental blast furnace at Bruceton, Pa., under a co-operative agreement with the U. S. Steel Corp., indicate that anthracite fines can replace part of the coke. The anthracite fines were injected intermittently into the melting zone by compressed air through auxiliary tuyeres. The fines can replace up to one-fourth the metallurgical coke normally required without sacrificing furnace performance.

Details of the tests are available in Report of Investigations 5648, "Injecting Solid Fuels into Smelting Zone of an Experimental Blast Furnace" obtainable from the Publications-Distribution Section, Bureau of Mines, 4800 Forbes Ave., Pittsburgh 13.

Extends Sand Range

STUDY indicates that by use of sodium silicate with a SiO_2:Na_2O ratio of 1:6 it is possible to prepare satisfactory CO_2 process molds from sands containing appreciable amounts of clay and higher moistures than are otherwise permissible.

Simplest application employs a mixture of about equal parts of dry, clay-bonded sand discarded after use, and undried silica sand. About 5 per cent silicate is used, and the moisture held to 3 per cent. Molds must be gassed thoroughly. Permeability of the sand should be at least 40. Details are presented in "The Use of Very Low Ratio Sodium Silicate in the CO_2 Process Leads to Sound Economy" by D. A. Taylor in the September issue of *BCIRA Journal* (Birmingham, England).

Separates Rare Earths

METHOD for determination of cerium and lanthanum in iron and steel where rare earths have been added is described in the article, "Separation and Determination of Rare Earth Elements in Iron and Steel II" by Shuro Takeyama, Emiko Sudo and Hidehiro Goto in *Science Reports of the Research Institutes*, Series A, Vol. 12, No. 5, Tohoku University, Sendai, Japan.

Rare earths can be separated from the iron by dissolving in a mixture of perchloric acid and hydrogen fluoride. Amount of cerium in the rare earth is determined colorometrically while the lanthanum is determined by flame photometry.

Increases Fatigue Strength

IN A PROGRAM sponsored by the National Aeronautics and Space Administration, the National Bureau of Standards recently investigated the effects of polar and nonpolar organic compounds on metal fatigue. Experiments showed that coatings of long-chain polar substances greatly increase the fatigue strengths of steel, magnesium, and copper-beryllium alloys. On metal surfaces the polar compounds apparently form tightly packed monolayers which act as a barrier to water and oxygen molecules.

Compounds having chain lengths of 8, 12, and 18 carbon atoms were studied and those having 12-carbon chains, such as dodecyl alcohol, apparently gave optimum conditions. Polar organic compounds caused an increase of over six times in the fatigue life of a magnesium alloy stressed at 12,500 psi, an increase of two and one-half times in a copper-beryllium alloy stressed at 50,000 psi, and of twice in an alloy steel stressed at 100,000 psi.

Gives Alloy Properties

RECENTLY the Brass and Bronze Ingot Institute, 300 West Washington St., Chicago 6, made available a reprint of a paper, "Mechanical and Physical Properties of Five Copper-base Casting Alloys," by W. H. Johnson and J. G. Kura which was presented at the 1960 meeting of ASTM. The paper presents results obtained in a continuing program sponsored at Battelle Memorial Institute on accurate measurements of properties of copper-base alloys. The alloys include 76 Cu, 2½ Sn, 6½ Pb, 15 Zn; 20 per cent nickel silver; 81-4-15 silicon brass, and the 65,000 and 110,000 psi manganese bronzes.

Strong Graphite Products

DEVELOPMENTS of new metal-bonded graphite materials combining the strength of metals with the antifriction properties of graphite is reported by Ford Motor Co. Potential of the materials is said to lie in the field of dry and externally lubricated bearings. They are made by mixing the powdered metals, graphite and some calcium silicon alloy, cold pressing them into compacts, and then sintering to liquefy the metal.

Cuts Analysis Time

SAVING of considerable time in determination of silicon in iron and steel by elimination of the lengthy double evaporations is described in "A Rapid Accurate Method for the Determination of Silicon in Carbon and Low-alloy Steels and Cast Irons" by C. G. Westwood in the November, 1960, issue of *Metallurgia* (Manchester, England).

The method originated from a study of the well-known modified Regelsberger method for determination of silicon in aluminum-silicon alloys. In the method the ortho silicic acid is converted from a hydrosol to a hydrogel of silicic acid in a single step without dehydration by addition of gelatine.

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ANOTHER BETTER METHOD FROM BEARDSLEY & PIPER

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FEMA

Full-scale figure for "Family Group" is carved and formed from baked oil sand

Bronze scale model of group to be cast is shown in the foreground

Sculptor Carves in Sand in

STATUARY MOLDING PROCESS

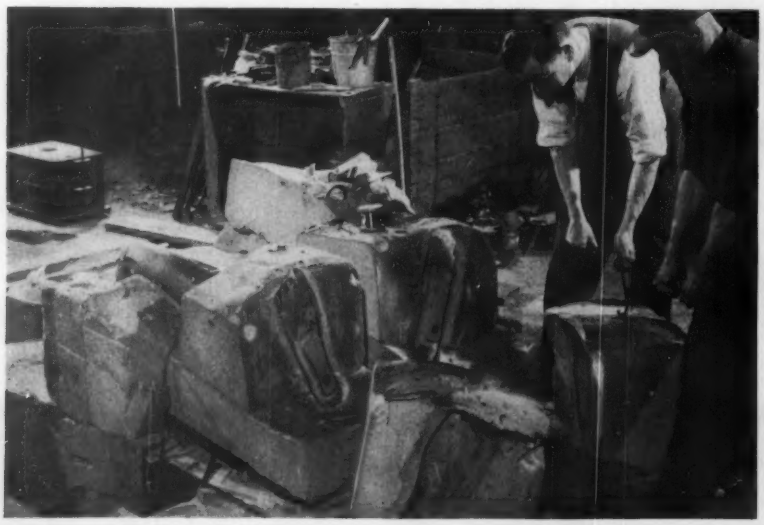
By ART PRICE
Cyrville, Ont., Canada

● SCULPTURING cores and molds for bronze statuary directly from the mold material is an idea that occurred to the author several years ago while watching foundry operations.

"Family Group" is the latest of more than 150 pieces ranging in size from 3 in. to 10½ ft tall produced by this method in the last five years. Five statues comprise "Family Group," which was completed for Prudential Assurance Co. of England, Montreal, Quebec.

Casting of statuary in brass or bronze in Canada is complicated by the fact that there are no art bronze foundries in that country. Also, the lost-wax process which has been most commonly used for statuary castings cannot be used for large statues because adequate burn-out facilities are lacking in the existing brass and bronze production foundries. By carving the prospective statue directly in sand and using this sand statue for a pattern from

Sections of larger molds of the male and female figures were assembled by hand



Full-sized models were used as patterns for molds, which were made by the CO_2 process

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Left to right, Dr. Charles Comfort, director of the National Gallery of Canada; the author and sculptor, Art Price; and Alan Jarvis, editor of *Canadian Art*, examine the finished sculpture, "Family Group"

which to make the necessary mold, dependence on the lost-wax process was eliminated.

First step in sculpturing these statues was to make a small model (scale 1 in. = 1 ft) in clay. After this model was approved by Prudential, a larger model (scale 2 in. = 1 ft) was prepared from clay and subsequently cast in bronze, using the clay model as a pattern for a CO_2-bonded sand mold. The work was done at Bond Brass Ltd., Ottawa, Ont., which, of course, had the necessary facilities for making the molds and melting and pouring the metal. William Bond, manager of Bond Brass, directed the pouring operations and advised on molding details.

The Full-Sized Figures—Work on the actual statues was begun by baking large blocks of oil-bonded sand. The statues were carved in sections from these blocks. Next, each statue was assembled from its sections so that a mold could be formed around it. The molding sand was bonded with sodium silicate and gassed with CO_2. A mold was set up in sections around each model and then disassembled so the model could be removed. Each model was relieved $\frac{3}{8}$ in. to allow for metal thickness, and it was ready to serve as the core.

The cores were vented and after the mold and the core had been given a mica wash, they were assembled. Cores were supported by chaplets where necessary and held down with large bronze rods. When everything was clamped securely and bedded in sand, the mold was ready for pouring. The statues were poured in 85-5-5-5 brass.

Finishing operations included cutting off runners, chipping off the many mold-joint fins, and grinding rough surfaces. The surface of each statue was oxidized to give a finished patina which is predominantly gold in tone with shadings of light brown and green to dark blue in recessed areas.

The result, which took six and a half months to accomplish, is a group of five statues assembled under the title of "Family Group." The mother, holding a baby, and the protective father are seated. The daughter and young son, embracing their parents, join in admiration of the infant. Over-all dimensions of the group are 8 ft, 7 in. tall; 9 ft, 6 in. long; and 5 ft wide.

The mother, infant, doughnut seats, and base are single castings. It was necessary to make the arms of the boy and girl and the right arm of the father as separate castings and join them to the bodies of the respective figures. Total weight of the group is 5950 lb.

Early Experiments—In the first experiments with such a process, green sand was used. Flat objects were carved from green sand in the positive. These pieces formed models for cope mold halves. After the copes had been molded, the models were trimmed to allow for metal thickness. Then, the relieved models served as the drag halves of the mold.

Carving molds in the negative was the next step in developing the present process. A mold was hollowed out in the shape desired, and baked sand cores were carved to make the castings hollow. The present method of carving each statue in sand and using this as the model for the mold was developed from this step.

Advantages of this process are that there is no waste and no loss of time. The method allows the artist to produce an original bronze and not a reproductive piece, although reproduction castings, of course, can be made from the original bronze.

Next Steps—Further work along these lines is being subsidized by a

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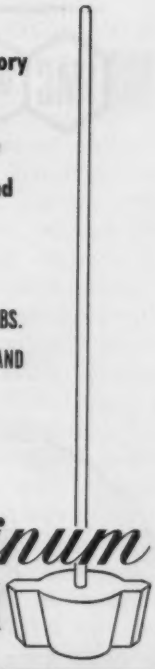

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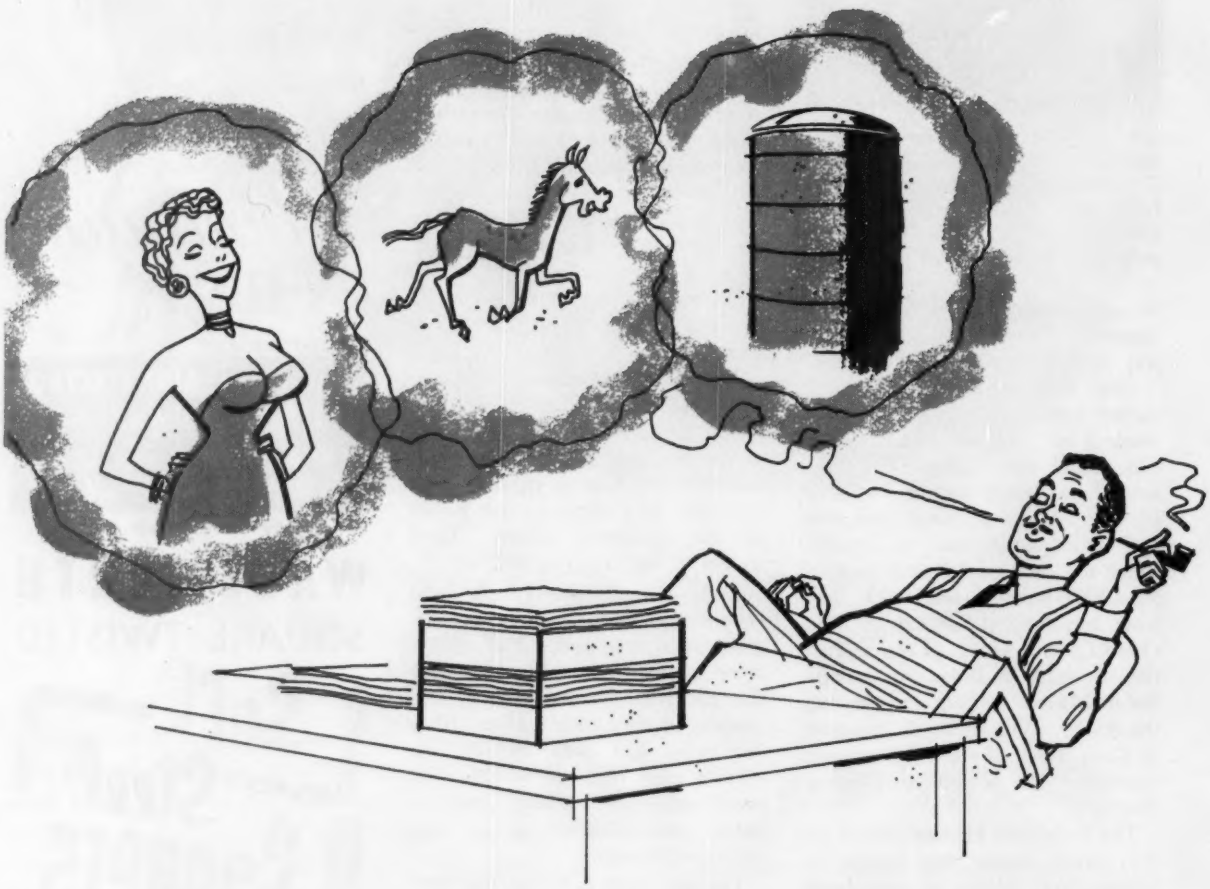
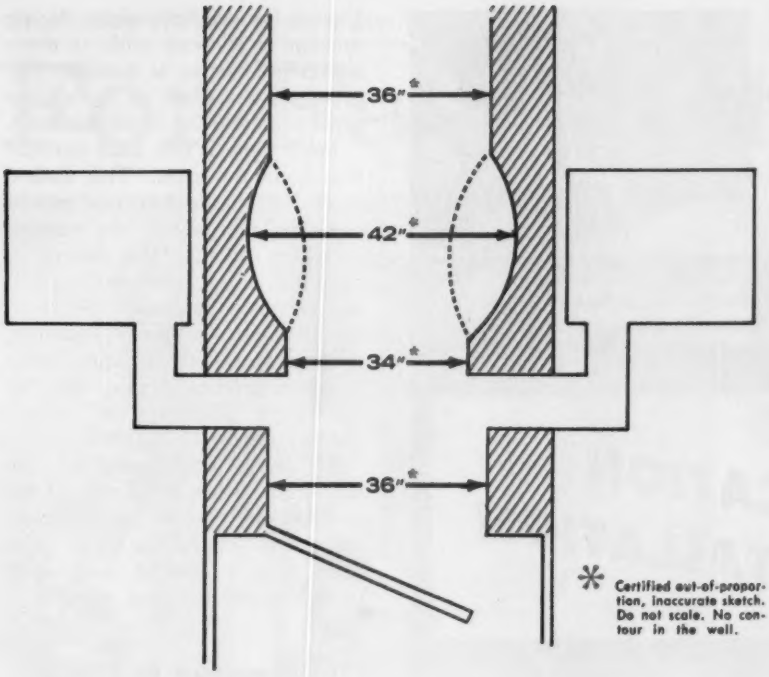
IMC A REPORT TO FOUNDRIES FROM TOM BARLOW



When is a contour?

Having recently dropped in on a cupola course of T&RI, I'm in the mood to talk cupola practice. Hope you are in the mood to listen. (Readers interested in sand and molding only, please come back next month.) Since the cupola is a complicated gadget, let's look at the patching practice. It is one important detail which is often slighted — both metallurgically and economically. Judging from the questions asked me, we can further narrow the talk to contour patching, and still have more to say than space permits.

Like most English words, "contour" means different things to different people. A friend of mine raises show horses — he refers to the excellent contour of his horses. Another friend reads *Playboy* (he's an amateur cook and they have wonderful recipes). He often quotes figures on contour that couldn't possibly refer to a horse. Since you and I are more interested in cupolas, contour refers to the dimension (diameter) of (1) the stack, (2) the melting zone and (3) across the tuyeres. A perfect 36-inch cupola, for example, might be 36-42-34.



Contour patching is logical, practical and economical. The secret is to patch the cupola to the same general shape it's going to end up at. (My kids say a preposition is a lousy thing to end a sentence with.) It's going to burn out that way anyway, so "if you can't beat them, join them." Occasionally the patching crew assumes that you should put in more patch where it burns out the most. This creates a Mae West (dotted lines) or boshed-in contour. Such shapes (in cupolas) are bad. They result in excessive burnout, slumping, bridging and other problems. The explanation can be made to sound complicated, but essentially it is related to the ability of the patch to let heat out — thermal conductivity. If some of the heat doesn't get out, the face of the lining gets too hot. As a result, slag attack is speeded up — along with more spalling and erosion. Burnout is rapid until the cupola again regains the proper contour and releases heat fast enough to keep the face down to a reasonable temperature.

This point can be illustrated by using the extremes. Insulating brick behind the lining has been tried; it failed miserably. Why? Because the heat couldn't *get* out — so the lining *burned* out. At the opposite extreme, some cupolas use water coolers behind a thin lining. The coolers don't *burn* out because the heat *gets* out.

To summarize, contour patching reduces the actual burnout because slag reactions are slower and spalling and erosion are reduced. It is cheaper. Maybe even more important, however, is the improvement in melting practice. Reducing the burnout obviously reduces the change in dimension. In other words, the cupola diameter is more uniform. When this is true, you are more apt to get uniform cupola operation — and, therefore, more uniform metal. Surely it is difficult to have uniform pressure, melting rate, carbon, silicon, etc., when a cupola changes from 36-28-34 in the morning to 36-46-34 by night. How much easier to start with 36-42-34 and burnout to 36-46-34.

As usual, we have a financial interest in this problem. (Honesty is *so* necessary these days.) We originated gun patching twelve years ago because gun patching is by far the easiest way to patch to a smooth, uniform, controlled contour. We now have four models of guns (Cupolinors) ranging from less than $1,000 to over $4,000, depending upon the speed of patching required. We have remote controls, "one-man" operation, high speed, low speed and every possible combination. Nowhere else can you find such a wide choice — and therefore meet your needs exactly.

We are also the world's most experienced producers of gun patching materials (like I said, we originated the process). Even here we have two "models." Cupoline is the original. It has maximum refractoriness, compaction and density for larger cupolas and high-temperature operations. Cupoline 77 is the newest of the gun patch materials. It is a low-rebound, high-fusion material with a higher alumina-silica ratio for shorter heats, smaller cupolas and maximum slag resistance. *Both* are carefully prepared, scientifically blended and manufactured products. You can depend upon them being the same, car after car, because we make them that way. May we help you to improve your contour?

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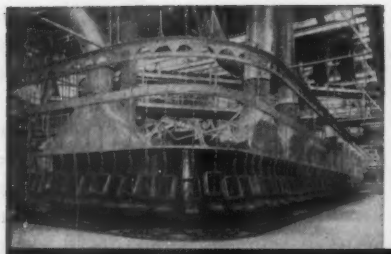

View in new Southern Foundry, shows pouring station with K & B system which removes smoke and fumes as they are formed.

"Shakeouts" in the foundry of a noted implement firm equipped with K & B Dust Control System.

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Canada Council Fellowship. We are attempting to work with as many methods of casting as possible. The experiments include all the various types of pattern or model materials.

Polystyrene is one mold material that helps the artist. This method is similar to the lost wax process but does not require the burnout operation because the pattern is vaporized as the molten metal is poured into the mold. Since an artist, much less many foundries, does not possess this equipment, the lost wax process is good only for the artist with an art bronze foundry nearby.

By using polystyrene for the model, the artist can do most of the work himself except for the melting and pouring of the metal. The same thing is true of the process using a sculptured sand model.

1961 Symposium on Light Metal Industry Planned

National Metallurgical Laboratory, Jamshedpur, India, will hold a symposium on the "Light Metal Industry In India" in early February, 1961. The symposium is being held to focus attention on the latest research and developments in the field of light metals and their alloys.

The symposium will cover raw materials for light metals industry, techniques of production, recent technological advances in metal casting, resistance properties of light metals, and present status and future expansion of the light metal industry in India.

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SILICONE NEWS from Dow Corning

For Fast Get-away

Silicones Speed Production of Crankshafts for Ford Falcons

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Circle 611 on Page 39

Man to Man

By RALPH L. LEE, *President*

Lee Hobby Foundry
Birmingham, Mich.

"There is just as much skill, if not more, hidden away in a thoroughly mechanized foundry than there ever was in the days of yore"

The Skill Factor in Foundries

● I STILL can remember the sound of a chorus of light metal tappings coming through the open windows of the pattern shop of the National Cash Register Co. when I was a youngster. I also remember finagling my way inside to see what it was all about.

Facing their benches and the open windows, a long line of middle-aged men with little hammers tapped tiny chisels against curlicues, bunches of grapes, leaves and vines, cherubs and flowers, and a stippled background on highly ornamental metal patterns for the cast brass and bronze cabinet parts of cash registers. I learned that these men were called chasers (a craft term).

Before each chaser, on the benches, were dozens of chisels to select from, and they managed to do so without even looking up. The kindly foreman showed me a variety of finished jobs on which I could not find one chisel mark, so skillfully and smoothly had each tiny detail been handled. With the exception of a few apprentices, I learned, all of the chiselers had been imported from Europe. Later when I tried a bit of chiseling on my own (still in a craft sense), I could see why the men had been imported.

The green sand castings from these patterns looked as though they had been coined. Even after all these years, I can't keep them out of mind when I hear discussions of green sand precision and finish versus those of the shell, plaster, lost wax, and CO_2 processes.

No Tears for Good Old Days—A tear for the good old days of craftsmanship in either chasing or foundry practice might be expected from the old amateur, but I'll have to confess that my eyes are bone dry. I have a sneaking hunch that there is just as much skill, if not more, hidden away under the cover of statistical quality control, time and motion study, production engineering, and mechanization than there ever was in days of yore. Just to learn the language and how to fill out the forms probably would require a longer apprenticeship than that of the most skillful of those chasers I watched.

Standing one day with the foreman of one department of an up-to-date foundry, I watched one of his operators going to town on a jolt-squeeze, automatic-draw machine, with no flourishes and every move counting. Just to be facetious, the foreman said "Go ahead and try one, Doc."

"Yeah," the operator butted in, "nothin' to it."

Like a fool, I took the bait. To their seeming surprise, I managed to flounder through the operation without hurting myself or the equipment, but I certainly made an ass of myself in comparison with the skillful performance of the operator.

I'll also never forget the amazing display of skill exhibited as I watched a man snagging cast malleable nuts in a foundry I visited with the president. In fact, he steered me to this fellow.

Every once in a while some distinguished foundry supervisor or manager visiting the Lee Hobby Foundry wants to demonstrate that he hasn't lost his foundry touch and grabs a shovel to help me out, proving to both himself and me that skill is a matter of practice which has to be kept at.

Highly Developed Skills—Unless a fellow is blind or doesn't give a darn, he hardly can walk through even the most thoroughly mechanized, high-production foundry without seeing example after example of highly developed skills he'd be foolish to try to imitate, regardless of his over-all sophistication in foundry matters.

The Nonexistent Average—Sometimes I wonder whether we are cheating ourselves when we set up some highly involved production system based largely on the statistical data which we think represents the capability of the nonexistent average individual. Such a system would, of course, safeguard us from the below average fellow because it would automatically chuck him out. But the above average, the way above av-

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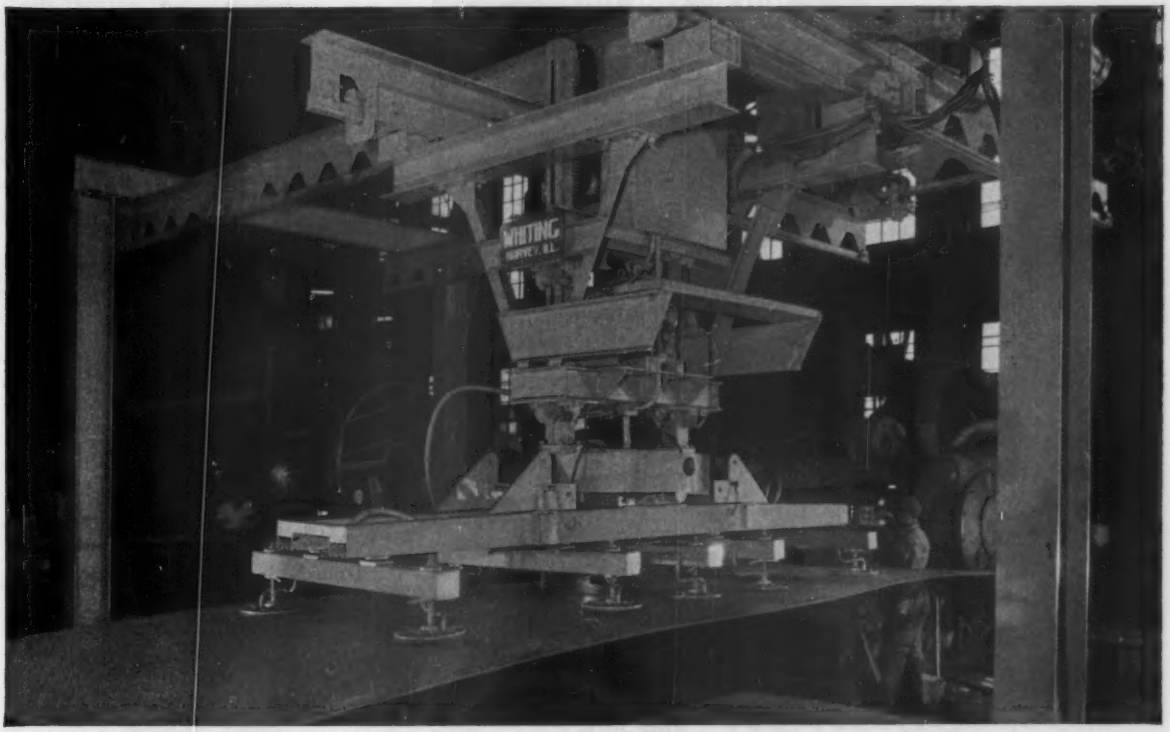

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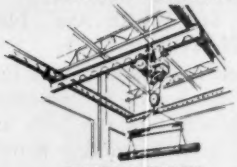
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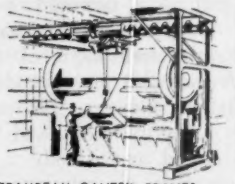
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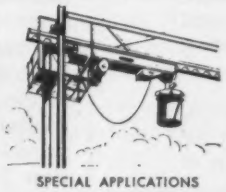
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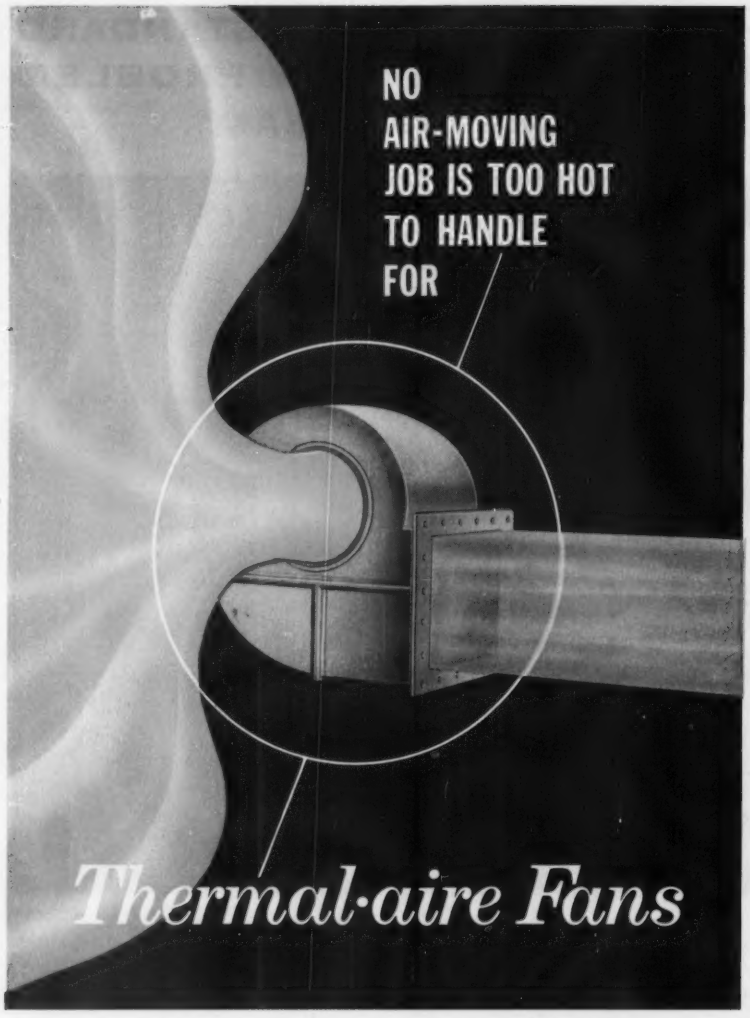

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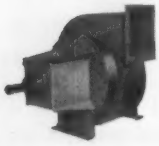

Write for Bulletin 960
Garden City Fan & Blower Co.,
825 N. Eighth St., Niles Michigan.

erage, and the superduper genius automatically would be slowed down. In fact, he couldn't even try to show what he was capable of.

I realize that there are a lot of ifs and buts mixed up in this sort of philosophizing, but, on the other hand, I'm convinced that no one really knows the top limit of the productive skills any individual is capable of developing. I think that all of us must know that no skill will be voluntarily developed to its limit unless there's elbow room to do it in or unless there are encouragement and recognition for acquiring it.

Maybe I've gone off the deep end here, but I can't get it out of my head that through a serious inventory or dollars-and-cents evaluation of the present skills now employed in every department of the business —skills we may have been taking for granted—we may be inspired to appreciate them and encourage their development. Here may be a field for profit beyond the capacity of mechanical devices—or, rather, let us say, in addition to mechanization. Few skills are likely to be developed to capacity without appreciative audiences.

Book Review

***Mechanics of Materials,* by Archie Higdon, Edward H. Ohlsen, and William B. Stiles, John Wiley & Sons Inc., 440 Fourth Ave., New York 16, N. Y. Price $7.75.**

This book is designed for a first course in mechanics of materials. General objectives of the book are the following: 1. A working knowledge of the relations between the loads applied to a nonrigid body made of a given material and the resulting deformations of the body. 2. A thorough understanding of the relations between the loads applied to a nonrigid body and the stresses produced in the body. 3. A clear insight into the relations between stress and strain for a wide variety of conditions and materials. 4. Adequate procedures for finding the required dimensions of a member of specified material to carry a given load subject to stated specifications of load and deflection.

The authors emphasize the required fundamental principles, with numerous applications to demonstrate and develop logical, orderly methods of procedure.

Circle 613 on Page 39

New Safety-Lock Tab • Improved Cup Shape Add Increased Protection and Comfort to AO Flexible Mask Goggles

Here are four improvements that make these new AO Vinylite Mask Goggles safer to use, more comfortable to wear:

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Circle 614 on Page 39

One conference feature was roundtable discussions on various subjects. At left is a group concerned with shell molding under the leadership of W. Bopp, Midwest Foundry Co. Right, Dick Requat, Dow Chemical Co., leads die, mold, and pattern discussion

Attendance Sets Record at

Michigan Regional Conference

By EDWIN BREMER
Metallurgical Editor

● ATTENDANCE of more than 400 at the Michigan Regional Foundry Conference held at Hotel Bancroft, Saginaw, Mich., Nov. 3-4, set a record for the annual event.

The conference was sponsored by Saginaw Valley, Central Michigan, Detroit, and Western Michigan Chapters of AFS. Student chapters at University of Michigan and Michigan State University also participated. A wide variety of subjects was discussed at ten technical sessions, two luncheons, and the annual banquet.

The group was welcomed by George R. Frye, Eaton Mfg. Co., Vassar, Mich., and chairman of the Saginaw Valley Chapter. He pointed out that the Saginaw Valley is a great foundry center since it is the location of several of the largest foundries of their type in the country. These include a gray iron foundry pouring 3700 tons a day, a malleable foundry pouring 2000 tons a day, and a gray iron permanent mold foundry pouring 260 tons a day.

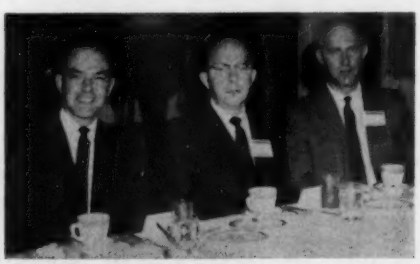
Technical discussions included **The Diecasting and Permanent Mold Processes** by L. G. Axford, Ford Motor Co., Dearborn, Mich. He pointed out that although there is some competition in the light and medium to small castings between the two methods of making castings, each tends to stand on its merits. Design is important in realizing all the advantages of the molding process, and must be considered carefully in each case.

In his discussion the speaker indicated factors that the product designer must take into consideration in the preliminary design stage, types of dies or molds used in both processes as well as machines and their operation, and advantages and disadvantages of the diecasting and permanent molding processes.

Advantages of diecasting include rapid production in long runs, production of complex shapes, close dimensional tolerances, easy coring, smooth surfaces, and thin sections. Limitations are higher die cost, large capital investment in equipment, tendency toward casting porosity, limitations on production of certain shapes, and inability to use sand cores.

Advantages of permanent mold casting are economy of short-run production, inexpensive tooling, short leadtime for tooling, superior structure in heavy sections, lack of limitation on weight and over-all dimensions, ability to heat treat castings to obtain maximum mechanical properties, and adaptability of a wide range of alloy compositions. Limitations include inferior surface finish, greater dimensional tolerance and machining requirements, and lower yield.

Magnesium Diecasting Process Development by S. L. Strong, AC



Left to right, D. N. Duncanson, Western Adjustment & Inspection Co., luncheon speaker; Jess Toth, Harry W. Dietert Co.; and V. J. Sadler, General Foundry & Mfg. Co., chairman of the conference

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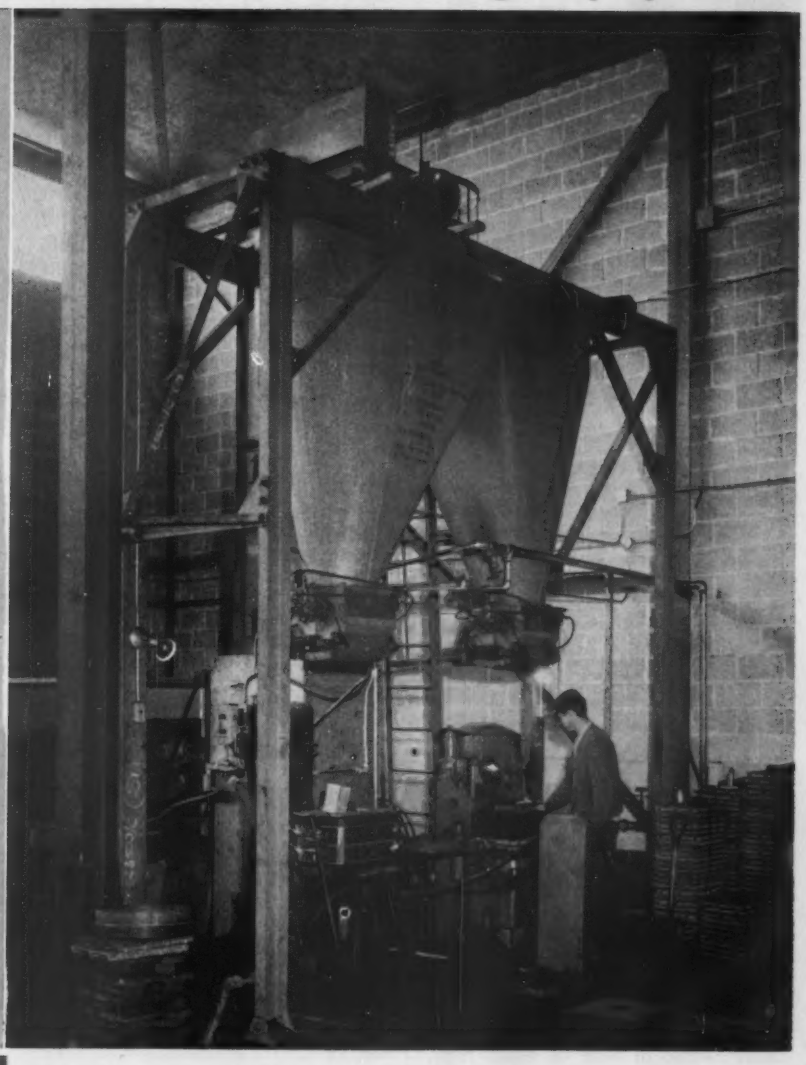
Photograph courtesy of Bell Foundry, Winnipeg, Manitoba



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Circle 615 on Page 39

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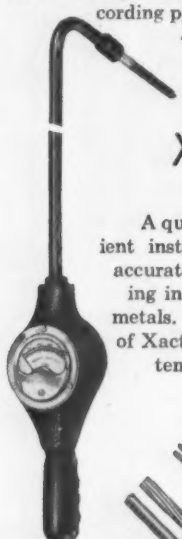

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Circle 616 on Page 39

Spark Plug Div., General Motors Corp., Flint, Mich., presented a step-by-step description of magnesium diecasting from entry to present stage at AC Spark Plug. Presently the firm is operating eight cold chamber diecasting machines in capacities ranging from 100 to 2000 tons locking pressure. Largest casting being produced is an instrument console for the Chevrolet which weighs about 4½ lb.

The speaker described details and operation of the various machines. He also discussed the methods of metering the metal into the cold chamber of the machine. Latest method is use of a vacuum which sucks metal through a tube from the furnace into the shot sleeve of the machine.

Ductile Iron—Present Applications and Future Potential by W. D. McMillan, Ohio Ferro-Alloys Corp., Chicago. Production of ductile iron castings requires understanding of the process from melting to solidification in the mold, and although more involved than that for gray cast iron, the process is pretty well understood. Ductile iron offers a high strength to hardness ratio with good impact resistance and ductility, and is used profitably where stresses are such that less ductile material is not satisfactory.

Most profitable application of ductile iron is in equipment designed to take advantage of its mechanical properties. Ductile iron castings are being used in place of intricate forgings, but are less competitive with simple forgings. Increased use of ductile iron is a matter of acquainting design engineers with the characteristics and properties of the material, and the advantages of castings over fabricated units.

Furfuryl Cores by T. B. Pfaff, Pontiac Motor Car Div., General Motors Corp., Pontiac, Mich. Prior to present developments in suitable furfuryl alcohol resin binders, curing first was effected by use of a toxic gas, later by substitution of solid chlorine compounds which evolved chlorine when activated by heat. In turn this led to inclusion of some urea formaldehyde resin with the furfuryl as well as the solid chlorine compounds, and the use of the heated corebox.

By varying the amount of the several ingredients, collapsibility of the cores can be adjusted over a wide range so that they can be used with light alloys as well as with ferrous and copper-base alloys. Smaller cores must be made solid, but in sections up to about 1 in. they cure rapidly—in a matter of seconds. In heavy sections a sufficiently heavy solid skin is developed in the hot box to permit the core to be removed. Curing of the interior then can be obtained by a short oven treatment.

Should You Consider an Automated Sand System? by Randolph Dietert, Harry W. Dietert Co., Detroit. In recent years the electronics industry has provided many devices which have simplified the design and maintenance of automatic control circuits. These devices include the electro-pneumatic transducer, the infrared sensitive resistor, the temperature-sensitive resistor and condenser, and the enclosed dust-tight, plug-in type relay which have improved greatly the reliability of automatic circuitry.

With some of these instruments it is possible to develop a completely automated sand system in a series of steps over a long period of time instead of having to do it all at one time. Mr. Dietert described how sand can be handled in an automated system, using various types of instruments to control the processing of the sand.

How Do You Plan, Build and Place a New Foundry in Operation? by J. W. Nuss, American Standard Corp., Louisville, Ky., and **Setting Up a New Foundry** by Eric Welander, John Deere Malleable Works, East Moline, Ill. Papers discussed procedures employed in determining requirements for two new foundries, planning of the arrangement of equipment for efficient and economical operation, and results obtained when the foundries were placed in operation.

How To Sell Castings to the Aircraft Industry by Harry Gravlin, Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn. Castings can help the aircraft industry to meet short leadtimes. In general, however, the demand for castings is a low-volume proposition, involving perhaps 1000 to 1500 castings in two to three years with numerous changes in design during the period. Sound cast-

ings of course are a must, but they are not too difficult to produce by experienced, technically competent foundries. Surface appearance is quite important, and close attention to that factor minimizes rejections. Aircraft firms are willing to pay good prices for castings which will meet their requirements.

Carbon Dioxide Process by Ray Fisher, Grand Rapids Foundry Div., Oliver Machinery Co., Grand Rapids, Mich., and Tom Barlow, Eastern Clay Products Dept., International Minerals & Chemical Corp., Skokie, Ill. Use of the process in making cores was described briefly by Mr. Fisher who said that in general 1 lb CO_2 is sufficient to harden 100 to 250 lb of silicate-bonded sand, depending on the thickness of the core and the amount of silicate used. Pressure may range from 15 to 40 psi. Treated celluose additions to the sand aid collapsibility. Cores often are coated with washes to give smoother surfaces, and it is preferable to use those compounded with an alcohol carrier. Where water-soluble binders are used, the core must be oven dried prior to use.

In CO_2 molding sands Mr. Barlow indicated that use of 2 per cent clay and coarser sands permits better ramming. Since clay tends to absorb moisture, the moisture content of the molding sand should be increased 0.5 to 0.75 per cent prior to the addition of the silicate binder. In larger molds, use of CO_2 type sand as a facing backed up with regular green sand reduces molding cost and gives good results.

Fundamentals of Casting Design by John L. Flitz, Central Foundry Div., General Motors Corp., Saginaw, Mich. Primary requirement of a good casting is that it perform its intended function satisfactorily. Also, cost of the finished product must be held to the minimum. To achieve those aims requires an interchange of ideas between designer and the foundryman; how that is done was shown in numerous slides depicting original and improved designs of castings.

An innovation at this conference was the holding of separate group or roundtable discussions which covered nine different subjects. The subjects and discussion leaders were as follow: **Ductile Iron**—H. E. Henderson, Lynchburg Foundry Co., Lynchburg, Va.; **Malleable Iron**—E. F. Chojnowski, Albion Malleable Iron Co., Albion, Mich.; **Cupola**—Howard H. Wilder, Vanadium Corp. of America, Chicago; **Shell Molding**—W. Bopp, Midwest Foundry Co., Coldwater, Mich.; **Dies, Molds and Patterns**—Richard Requat, Dow Chemical Co., Bay City, Mich.; **Ferrous Casting Problems**—M. Warchol, Atlas Foundry Co., Detroit; **Diecasting**—R. Carrol, Ternstedt Div., General Motors Corp., Flint, Mich.; **Permanent Molding**—George R. Frye, Eaton Mfg. Co., Vassar, Mich., and **Foundry Sands**—T. W. Seaton, American Silica Sand Co., Ottawa, Ill. At the conclusion of the session which lasted about 1¼ hours, the leaders of the various groups presented brief reports of the discussions which had taken place during the roundtable discussions.

At a session for students from various schools and universities in the area who attended the conference on the last day as guests of the sponsoring chapters, **Career Opportunities in the Foundry Industry** was discussed by Ralph Betterley, Training & Research Institute, AFS, Des Plaines, Ill., and in addition a film, **Cast Metals and You** was shown.

Book Review

The Routine Analysis of Copper Base Alloys, **by Frank J. Versagi, hard cover, 168 pages, 5½ x 8¾ in., published by Chemical Publishing Co., New York 10. Price, $5.**

Written for the laboratory worker, whether chemist or technician, this book presents in readily usable form those methods which have proved most effective in the analytical laboratories of the brass industry.

Test methods are listed for twenty elements found in copper-base alloys. General notes relating to several methods are given at the beginning of each chapter, and the individual methods are followed by discussions. Several methods are presented for the more common elements so that the chemist may choose the one which is best suited to his needs.

Each method is complete in itself, written so that it can be followed step by step, from the weighing of the sample to the final calculation, without referring to other sections or pages.

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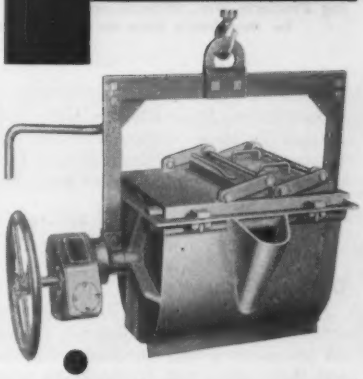

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Circle 617 on Page 39

Literature for Foundrymen

For More Information Use Reader Service Card—Page 39

Arc Welding

Bulletin MW-259 explains the multi-operator welding system and its principles of operation, describes advantages of the system, and illustrates a number of installations.—**A. O. Smith Corp., Welding Products Div.**, Milwaukee 1, Wis.

For More Details Circle No. 402—Page 39

Bucket Elevators

Specification data, selection tables, and diagrams explain company's bucket elevators and accessories. Dimensions of various models are also given.—**Chain Belt Co.**, Milwaukee 1, Wis.

For More Details Circle No. 403—Page 39

Optical Pyrometer

ND42-35 data sheet illustrates and describes construction and operation of optical pyrometer. It lists standard pyrometers and their ranges and accessories to adapt them to specific measurements. Equipment for comparison checking also is listed.—**Leeds & Northrup Co.**, 4901 Stenton Ave., Philadelphia 44, Pa.

For More Details Circle No. 404—Page 39

Stacker

Circular 34-K describes 2000-lb capacity stacker with built-in charger which works on 115-v, ac outlet for overnight recharging. Folder also contains specifications and an explanation of stacker's features.—**Lewis-Shepard Products Inc.**, 125 Walnut St., Watertown 72, Mass.

For More Details Circle No. 405—Page 39

Thermocouple Wire

Catalog C-100-2 contains information on thermocouple wire and on bare and insulated extension wire. It also lists prices and ordering directions.—**Minneapolis-Honeywell Regulator Co.**, Wayne and Windrim Avenues, Philadelphia 44, Pa.

For More Details Circle No. 406—Page 39

Laboratory Equipment

Brochure 60-9-74 describes and illustrates various models and types of laboratory apparatus and instruments and includes specifications and prices.—**Burrell Corp.**, 2223 Fifth Ave., Pittsburgh 19, Pa.

For More Details Circle No. 407—Page 39

Work Gloves

Selector manual covers basic types and styles of work gloves, grades of leather, chemical resistance, and physical properties of various plastic coatings. Also included are basic features of canton flannel, jersey, leather, terry cloth, neoprene, and hot mill and welders' gloves.—**Riegel Textile Sales**, 260 Madison Ave., New York 16, N. Y.

For More Details Circle No. 408—Page 39

Battery Chargers

Bulletin AR-109 describes line of chargers for 12, 15, 16, and 18-cell industrial truck batteries. Bulletin details nature of the constant potential automatically regulated circuit, shows charging characteristics, and provides electrical and mechanical details.—**C & D Batteries**, division of Electric Autolite Co., Conshohocken, Pa.

For More Details Circle No. 409—Page 39

Shotblast Machines

Booklet describes rotary shotblast tables and gives standard table sizes. The folder also includes specifications and dimensions of the tables. A diagram illustrates an installation.—**F. E. North America Ltd.**, 47 Advance Rd., Toronto 18, Ont., Canada.

For More Details Circle No. 410—Page 39

Ferroalloys

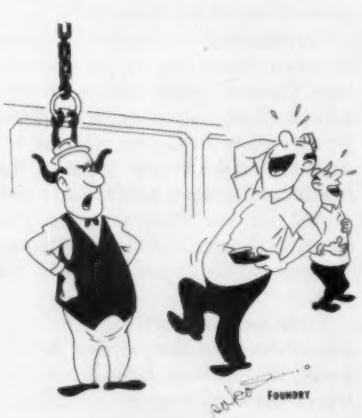
Brochure lists the chemical compositions and applications of more than 90 ferroalloys, metals, and chemicals.—**Vanadium Corp. of America**, 420 Lexington Ave., New York 17, N. Y.

For More Details Circle No. 411—Page 39

Industrial Silencers

Bulletin B-13 explains methods for handling problem of noise generated by gas flow devices in industry. The acoustic and aerodynamic characteristics of the company's gas handling silencers are described. Included are diagrams of the models available and design charts.—**Silence Inc.**, P. O. Box 21, Farmingdale, N. Y.

For More Details Circle No. 412—Page 39



"What's so funny?"

Radiography Cameras

Sheet describes cobalt 60 panoramic radiography cameras and explains their construction and operation. It also lists specifications for five models of the camera.—**Radionics Inc.**, Lafayette and Water Streets, Norristown, Pa.

For More Details Circle No. 413—Page 39

Gating Zinc Diecastings

Booklet on gating of zinc diecastings discusses multiple cavity arrangements, runner and sprue and overflow well details, and gating and die temperature.—**American Smelting & Refining Co.**, 120 Broadway, New York 5, N. Y.

For More Details Circle No. 414—Page 39

Insulation

Sheet contains information on refractory fiber insulation and lists the available forms, recommended uses, and advantages of the material. Tabular data covers thermal conductivity at various densities and temperatures and listings of standard densities and thicknesses.—**Johns-Manville**, 22 E. 40th St., New York 16, N. Y.

For More Details Circle No. 415—Page 39

Infrared Heating

Booklet enumerates typical applications and advantages of infrared heating. Data on electrical specifications, radiation distribution patterns, and dimensions are included.—**Fostoria Corp.**, 1200 N. Main St., Fostoria, Ohio.

For More Details Circle No. 416—Page 39

Induction Heating

Handbook pictures latest developments in induction heating equipment. It also contains factual descriptions, specifications, and work performance charts. One section of the book is devoted to improved electronic induction heating generators.—**Induction Heating Corp.**, Dept. PR-2, 181 Wythe Ave., Brooklyn 11, N. Y.

For More Details Circle No. 417—Page 39

Aluminum Alloys

Brochure describes company's Ternalloy series aluminum alloys, which develop mechanical properties without heat treatment. The brochure features chemical compositions, physical properties, and

MR. FOUNDRYMAN:

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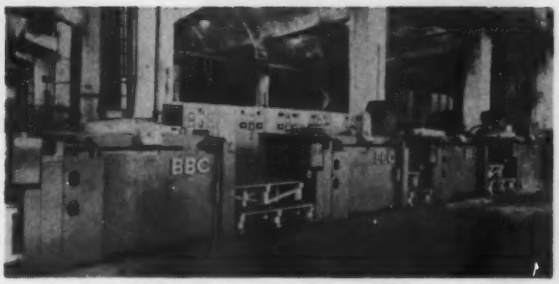

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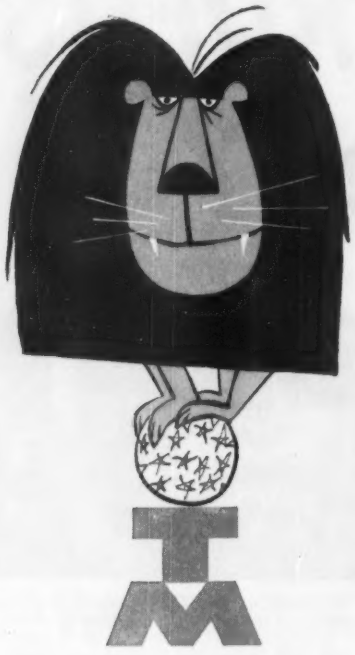

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Circle 619 on Page 39

characteristics of Ternalloys in sand, plaster, and permanent mold applications.—**Apex Smelting Co.**, 2537 W. Taylor St., Chicago 12, Ill.

For More Details Circle No. 418—Page 39

Vibrating Feeders

Folder 2770 describes two models of vibrating feeders available in 30 sizes with capacities up to 1350 tph. Selection

and application data based on feeder size and total vibrating weight are given.—**Link-Belt Co.**, Dept. PR, Prudential Plaza, Chicago 1, Ill.

For More Details Circle No. 419—Page 39

Induction Motors

Bulletin 6100.1 describes design features, performance characteristics, and size range of redesigned line of squirrel cage induction motors.—**Lincoln Electric Co.**, Cleveland 17, Ohio.

For More Details Circle No. 420—Page 39

Slings and Connectors

Illustrated brochure presents specifications and working load limits for alloy chain slings, rings, links, and hooks. Literature describes the advantages of alloy chain slings and of company's alloy chain connector link.—**Jones & Laughlin Steel Corp.**, 3 Gateway Center, Pittsburgh 30, Pa.

For More Details Circle No. 421—Page 39

Grinders

Bulletins 108 and 110 illustrate and describe firm's line of grinders and list standard specifications for each type of grinder.—**Grinding & Polishing Machinery Corp.**, 2530 Winthrop Ave., Indianapolis 5, Ind.

For More Details Circle No. 422—Page 39

Weight Indicator

Bulletin M-39 describes weight indicators for all types of cranes and gives specifications and installation information.—**Martin-Decker Corp.**, 3431 Cherry Ave., Long Beach 7, Calif.

For More Details Circle No. 423—Page 39

Centrifugal Fan

Catalog 1125 discusses construction features of firm's centrifugal fan. It explains the effects of temperature and altitude and presents typical specifications, performance and engineering data and dimensions of the Centriline fan.—**Westinghouse Electric Corp.**, Sturtevant Div., Hyde Park, Boston 36, Mass.

For More Details Circle No. 424—Page 39

Relay Conversion Kits

Folder discusses the use of color coded conversion kits to modify standard relays. It includes color location diagrams, general instructions, a coil application table, and data on volt-ampere requirements.—**Clark Controller Co.**, 1146 E. 152nd St., Cleveland 10, Ohio.

For More Details Circle No. 425—Page 39

Metallurgical Apparatus

Brochure illustrates and describes cutters, grinders, mounting presses, portable and table mounted polishers, electrolytic etchers, and cleaners and gives dimensions, price, and weight of each piece of equipment.—**Buehler, Ltd.**, 2120 Greenwood St., Evanston, Ill.

For More Details Circle No. 426—Page 39

Diecasting Machines

Brochure illustrates and describes plunger gooseneck and cold chamber diecasting machines. It gives a description, specifications, and range for each machine.—**Kux Machine Co.**, 6725 North Ridge, Chicago 26, Ill.

For More Details Circle No. 427—Page 39

X-Ray Wall Chart

Wall Chart M4-26, "The ABC's of Industrial X-ray Film Processing," is a guide to X-ray film tank processing procedures for radiography department personnel.—**Eastman Kodak Co.**, X-ray Div., Rochester 4, N. Y.

For More Details Circle No. 428—Page 39

Deoxidizer

Brochure contains a description of products for deoxidizing molten steel. Included are grained deoxidizers for slag control of stainless steels, screened and bagged shot deoxidizers, slugs for use in shank ladles, and 4 and 6-notch bars.—**Brown Aluminum & Chemical Co.**, 4850 Overlook Rd., Cleveland 25, Ohio.

For More Details Circle No. 429—Page 39

Dock Plates

Bulletin TLP-460 illustrates some typical truck loading situations and lists firm's 16 standard truck loading plates, with dimensions, capacities, and other specifications.—**Magline Inc.**, 1900 Mercer St., Pinconning, Mich.

For More Details Circle No. 430—Page 39

Safety Headgear

Leaflet illustrates and describes various styles and types of safety hats and liners and lists other accessories.—**Apex Safety Products**, Division of White Sewing Machine Corp., Washington & Elm Sts., Cleveland 13, Ohio.

For More Details Circle No. 431—Page 39

WEDRON

A COMPLETE LINE OF 24 DIFFERENT PROCESSED SILICA SANDS

A CONTROLLED GRADE FOR EVERY CASTING NEED!

SAND SPECIFICATIONS — REPRESENTATIVE SCREEN ANALYSES

Unground Sand	4098	4085	4060	4040	4030	4020	5040	5030	5025
Ret on 20 Mesh	2.2								
Thru 20 ret on 30	38.6	12.4	5.6	0.6	0.4	0.4			
Thru 30 ret on 40	57.6	70.8	56.2	37.2	30.2	21.2	4.0	1.2	0.6
Thru 40 ret on 50	1.4	16.3	34.8	52.0	55.8	51.4	34.8	30.4	23.8
Thru 50 ret on 70	0.2	0.5	2.8	9.0	11.4	20.6	44.4	48.2	42.0
Thru 70 ret on 100			0.6	1.0	1.8	5.2	14.4	17.8	26.4
Thru 100 ret on 140				0.2	0.4	1.0	2.0	2.0	6.2
Thru 140 ret on 200						0.2	0.4	0.4	0.8
Thru 200 ret on 270									0.2
Grain Fineness (AFS)	25.88	30.49	33.72	37.48	38.82	42.22	49.96	51.64	56.90

Unground Sand	5015	5010	5005	7030	7020	7010	C-30	C-10
Ret on 20 Mesh								
Thru 20 ret on 30								
Thru 30 ret on 40	1.2	0.4	0.2	0.2	0.2			
Thru 40 ret on 50	15.2	11.2	4.4	3.0	2.4	0.4		
Thru 50 ret on 70	40.2	35.2	31.2	26.2	18.0	8.2	0.4	0.2
Thru 70 ret on 100	35.4	37.4	41.2	42.0	45.0	46.6	28.4	8.4
Thru 100 ret on 140	6.4	10.8	15.4	16.4	20.0	23.2	44.8	50.2
Thru 140 ret on 200	1.2	4.0	5.6	9.6	11.0	15.4	18.8	28.2
Thru 200 ret on 270	0.4	0.8	1.4	1.8	2.4	4.2	5.0	8.8
Thru 270 ret on 325		0.2	0.6	0.8	1.0	2.0	2.6	4.2
Grain Fineness (AFS)	60.20	66.92	73.92	79.36	84.42	95.44	108.22	124.60

Ground Sand (Flour)	80M	100M	140M	200M	300M	325M	400M
Ret on 60 Mesh	10/20%						
Thru 60 ret on 100	25/30%	5%					
Thru 100 ret on 140	15/20%	14%	4%	1%			
Thru 140 ret on 200	10/15%	16%	6%	4%	2%	Trace	
Thru 200 mesh	25/40%						
Thru 200 ret on 270		10%	12%	6%	2%	0.5%	Trace
Thru 270 ret on 325		12%	8%	9%	11%	4.5%	2%
Thru 325 mesh		43%	70%	80%	85%	95.0%	98%

99.9% PURE SILICA WEDRON SILICA COMPANY INDUSTRIAL SAND

FINE SHELL MOLDING SANDS
STANDARD CASTING SANDS — BLASTING SANDS
SILICA FLOUR — LIGHT METAL CASTING GRADES

Wedron offers you a complete line up of casting sands — anything needed for every *casting* need! This means you get the advantages of one source of supply for all the sand you need — sand of the highest quality, too.

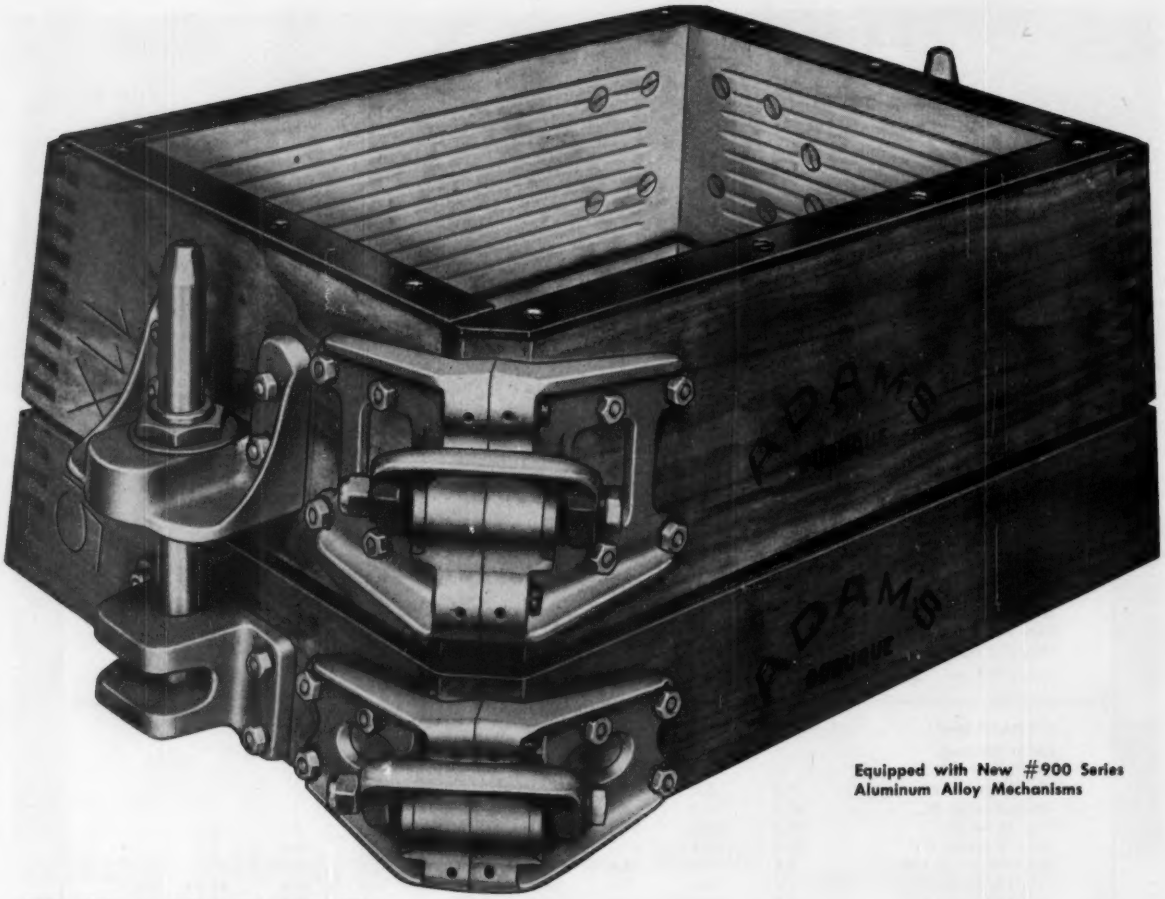
Now this Wedron quality stems from two factors. First is the naturally rounded grain sand of the Ottawa-Wedron district (this is held to be one of the purest silica sand deposits in the nation). Second is the modern, completely equipped Wedron plant, which turns out a superior silica product and makes all grades available.

Look to Wedron for the *complete* line of quality casting sands.

MINES AND MILLS IN THE OTTAWA-WEDRON DISTRICT

WEDRON SILICA COMPANY

135 SOUTH LASALLE STREET, CHICAGO 3, ILLINOIS



Equipped with New #900 Series Aluminum Alloy Mechanisms

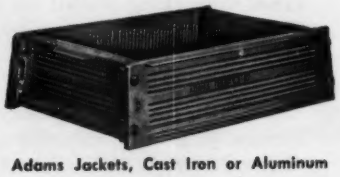
ADAMS CHERRY EASY-OFF FLASK

MAKE REAL SAVINGS FROM THESE ADVANTAGES!

CHERRY EASY-OFF FLASKS are of proven design and construction.
CHERRY LUMBER is the finest available, carefully selected and thoroughly air dried.
SIDES AND ENDS finished 1½" on all standard size flasks. 1¼" and heavier on flasks of larger perimeters and greater depths.
SOLID CORNERS are machine dovetailed and maintained in rigidness through dipping in "Hot Glue" and machine locking.
ALUMINUM ALLOY TRIMMINGS are also used on Adams Aluminum Easy-Off Flasks when specified.
OPERATING MECHANISMS are identical with those used on the Adams Aluminum Easy-Off Flask and incorporate the same simple adjustment and reversal of locking position.
STEEL PROTECTING STRIPS are standard equipment at top, bottom and parting. Aluminum strips available upon request at no extra charge.
HANDLES AND TRUNNIONS are available when specified, Tee Iron Trusses if required.
PIN AND EAR ARRANGEMENT available to interchange with present pattern plate guides.

A COMPLETE LINE. Adams flask equipment meets your requirements in practically all methods of production. Before you invest, get the Adams story first. Write today for our big profit-making catalog.

Adams Aluminum Easy-Off Flask



Adams Jackets, Cast Iron or Aluminum

The ADAMS Company

ESTABLISHED 1853

MOLDING MACHINES and FLASK EQUIPMENT

700 FOSTER STREET, DUBUQUE, IOWA, U.S.A.

Around the Country

NEWS REPORTS FROM

Philadelphia . . . Chicago . . . Pittsburgh

Chicago— International Harvester Co. has completed the planned program of its Farm Equipment Division to concentrate manufacturing in its more modern and efficient facilities.

This brings these developments: 1. Farm implement production at the small Rock Falls, Ill., plant will be transferred to the Canton, Ill., factory, and to West Pullman Works, Chicago; 2. Canton Works will transfer its gray iron production to five other Harvester foundries, making available about 125,000 sq ft of additional floor space for anticipated production needs at Canton.

The five foundries to which the gray iron work will be transferred are at Rock Island, Ill., Indianapolis, Louisville, Milwaukee, and Hamilton, Ont.

The program, which will be completed by end of 1961, will aid Harvester to safeguard its leading position in the farm equipment business. In the early 1950s, the company began a program to review its total farm equipment manufacturing capacity in relation to the postwar normal market, both in this country and abroad.

The study showed that the company had excess capacity. As a consequence, Harvester disposed of old farm equipment plants at Auburn, N. Y., in 1951, at Richmond, Ind., in 1957, and will complete the closing of McCormick Works, Chicago, in 1961. As in the case of those plants, the decision to close Rock Falls Works, to transfer its production to Canton and West Pullman Works, as well as to transfer Canton foundry production to other Harvester gray iron foundries, is a part of this long-range program of concentrating operations in the more efficient plants.

Canton Works employs 239 in the foundry and pattern shop. Foundry production is scheduled to end in May. Movement of foundry equipment is expected to be completed by July 1, when the foundry buildings will be cleared and made ready for other production.

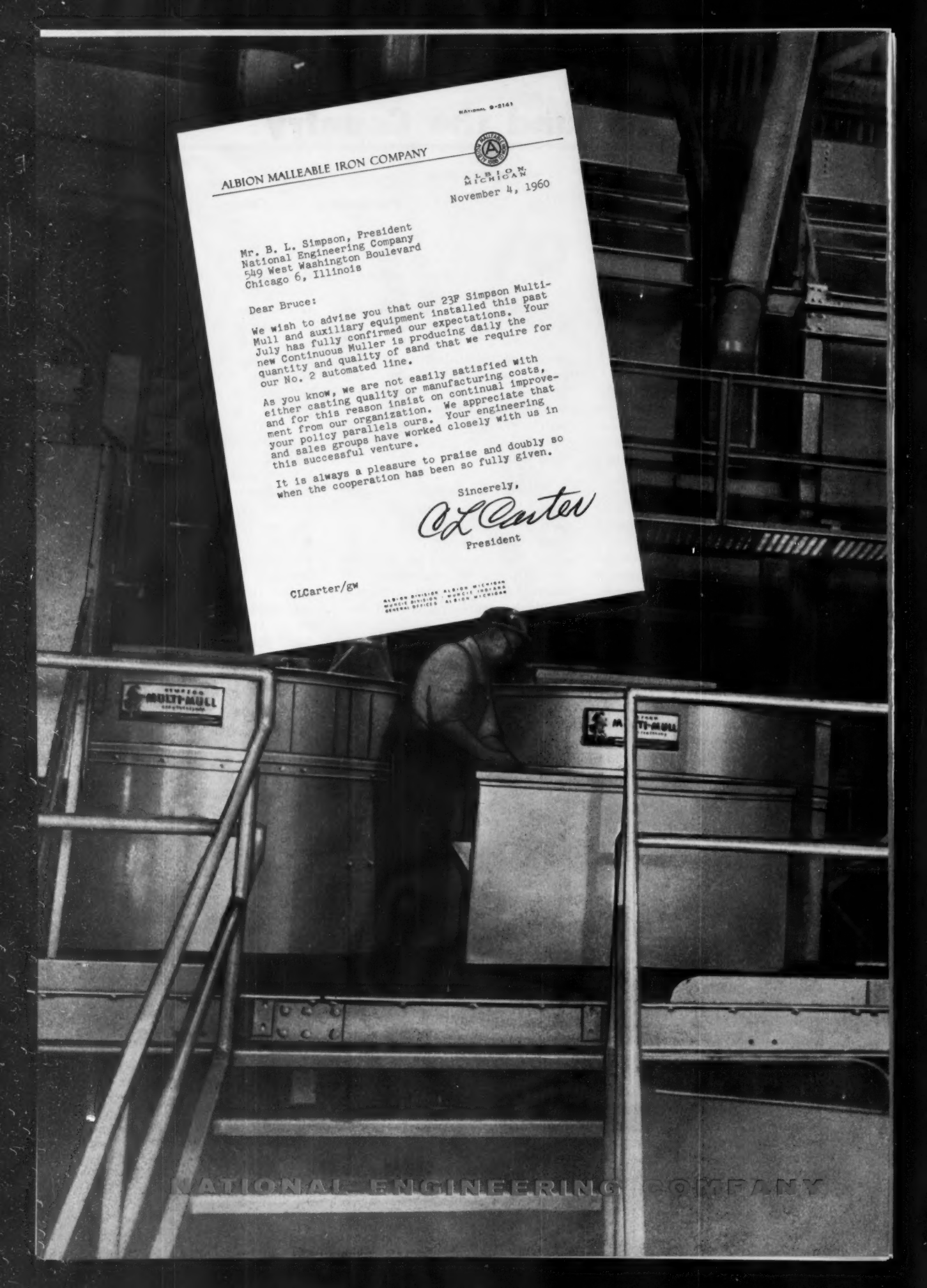
Because Canton Works' foundry is small—the smallest capacity gray iron foundry in the company—and production there has been at a low level in anticipation of the move, the company does not expect the distribution of its production to result in an appreciable increase in the schedules or employment at the other foundries.

Philadelphia— With consumer inventories low, foundries anticipate a mild improvement in demand which should be fairly apparent by February. The peak for the first quarter is expected in March, when seasonal influences should be stimulating general metalworking activity.

Currently a little more inquiry is noted, although buying continues on a hand-to-mouth basis, with deliveries easy. Gray iron foundries can ship within a week to ten days on most orders; steel foundries three to four weeks, as quickly as at any time in months; malleable shops around two to three weeks; and makers of bronze castings possibly ten days on an average. Light metals are tighter than most other lines, although consumers can obtain good deliveries by shopping around.

Most gray iron shops average four days a week with limited working forces. Percentagewise, they are operating, it is estimated, at around 57 to 60 per cent of normal capacity. In no consuming line does there appear to be any special activity. Requirements for papermaking and textile machinery are light. Only a moderate demand for castings is noted from manufacturers of material handling equipment. Auto die work is slow.

CONVEYOR GROUP ELECTS: Officers of the Conveyor Equipment Manufacturers Association for 1961 are, left to right, front row, E. H. Woodberry, Lamson Corp., president; Orlan A. Johnson, Gifford-Wood Co., director and retiring president; George H. Woodland, Chain Belt Co., vice president; E. L. Weinthaler, Conveyor Systems Inc., secretary; back row, H. A. Barber, Barber-Greene Co., director; L. E. Brill, Jeffrey Mfg. Co., director; H. E. Murken, Hewitt-Robins Inc., treasurer; and R. C. Sollenberger, executive vice president. Mrs. Jayne B. Spain, Alvey-Ferguson Co., not shown, also is a director


NATIONAL 9-2141
ALBION MALLEABLE IRON COMPANY
ALBION MICHIGAN
November 4, 1960
Mr. B. L. Simpson, President
National Engineering Company
549 West Washington Boulevard
Chicago 6, Illinois
Dear Bruce:
We wish to advise you that our 23F Simpson Multi-Mull and auxiliary equipment installed this past July has fully confirmed our expectations. Your new Continuous Muller is producing daily the quantity and quality of sand that we require for our No. 2 automated line.
As you know, we are not easily satisfied with either casting quality or manufacturing costs, and for this reason insist on continual improvement from our organization. We appreciate that your policy parallels ours. Your engineering and sales groups have worked closely with us in this successful venture.
It is always a pleasure to praise and doubly so when the cooperation has been so fully given.
Sincerely,
C L Carter
President
CLCarter/gw
ALBION DIVISION ALBION MICHIGAN
MUNCIE DIVISION MUNCIE INDIANA
GENERAL OFFICES ALBION MICHIGAN
MULTI-MULL
NATIONAL ENGINEERING COMPANY

SIMPSON
MULTI-MULL
AT WORK

In June of 1960, Albion Malleable Iron Company installed a continuous muller to serve a high-speed automated molding line. In so doing, they found the solution to a new and perplexing production problem . . . one that many foundrymen face today!

PROBLEM: *AUTOMATED MOLDING LINE HOGS SAND BUT IS "SENSITIVE" TO SAND PROPERTY VARIATION.*

Albion's high-speed No. 2 line is designed to turn out a mold every 15 seconds—240 per hour. The big 40 x 40 flasks require 1500 lbs. of mulled green sand each at the rate of 180 tons per hour. 2880 tons of sand must be prepared each day. Batch mullers could deliver neither the continuous quantity nor the uniformity of sand properties needed to insure top performance of this automated line.

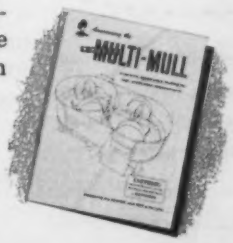
SOLUTION: *SIMPSON MULTI-MULL ...A NEW CONTINUOUS MULLING CONCEPT*

A Model 23F Simpson Multi-Mull put Albion Malleable back on schedule. A *continuous* flow of carefully controlled and conditioned mulled sand now helps to set the pace for automatic molding and Albion reports that molding characteristics of the sand are consistent with their needs.

THE ANSWER:

Mr. C. L. Carter, president of Albion Malleable Iron Company, is a man not easily satisfied with either casting quality or manufacturing costs. His experience with the Multi-Mull is typical of what *any* foundryman who aggressively wages the battle of cost and quality . . . can expect from this new production tool.

It will *pay you* to investigate how the Simpson Multi-Mull combines unparalleled productive capacity with the *quality* of prepared sand your modern system demands.



WRITE FOR LITERATURE

Circle 584 on Page 39

F161S

PRODUCTS OF THE PRACTICAL FOUNDRYMAN

[illegible] Machinery Hall Bldg. • Chicago 6, Ill.

In Canada: 17 Queen Street East, Toronto 1

Lack of demand for heavy industrial equipment is restricting steel casting sales. There is more estimating for various programs, however, which may mean orders a little later. Ship work is confined mostly to repairs, although Sun Shipbuilding & Dry Dock Co., Chester, Pa., recently booked orders for four cargo ships which eventually will be reflected in castings.

Casting inventories are down generally, one exception being in malleable fittings and plumbing supplies. Hardware requirements are off seasonally. Most malleable foundries are operating on a reduced schedule of three to four days.

Raw material supplies are in easy supply. Overnight shipments by truck are the rule. The Swedeland, Pa., producer of pig iron a few weeks ago brought in one of two blast furnaces, but recently blew out the second stack for repairs.

Pittsburgh— As they wind up a disappointing year, foundrymen are pinning their hopes for 1961 on recovery of the steel industry. Steelmakers take a large proportion of the castings made by local jobbing shops and when they're operating at low rates—as they did throughout the second half of 1960—they curtail their purchases sharply.

Since low ingot rates also reflect poor demand for finished steel, foundrymen have a second reason for wanting to see steelmaking operations pick up. Higher ingot rates would be indicative of greater demand from automakers, railroad car manufacturers, farm equipment producers, and machinery builders—all of whom buy large quantities of castings.

For most gray iron shops, November bookings were no better than October's. December started slowly and looked as though it might turn out to be worse than either of the two preceding months. In part, December's slowness may have reflected the natural reluctance of purchasing men to have their money tied up in inventories at the year end. Gray iron foundries will start the new year with negligible backlogs, reduced work forces, and operations averaging 30 to 40 per cent of capacity.

Steel foundries supplying the railroad car builders got a flurry of orders in December after announcing that they would raise their prices 5 per cent at year end. They tried to put over a similar increase 13 months ago, but it didn't stick. In effect, they're moving to reinstate a schedule that was originally published in November, 1959. Since the railroad order influx was stimulated artificially, sales executives fear that they're due for a slump in January. Customers who bought in December tried to cover most of their early first quarter requirements at that time.

It's believed that carbuilding programs will aggregate about $850 million and 40,000 units next year (vs. $950 million and 50,000 units in 1960).

The continuing trend toward survival of the fittest may help some local foundries in 1961. Many of them are angling for accounts that were previously held by now-defunct competitors. Reliance Steel Casting Co., one of the district's leading foundries for 50 years, has gone into liquidation. Bucyrus-Erie Co., Erie, Pa., has announced plans to close its captive shop while continuing to operate its plant.

CMD®

THE
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hammer
WITH
SWING BALANCE

This is the hammer with the balanced feel—swings easy, fits the hand properly, absorbs shock. *Less fatigue* and it's a pleasure to use!

CMD heads are made of ¾" square tool steel. They can be re-sharpened right down to the shaft!

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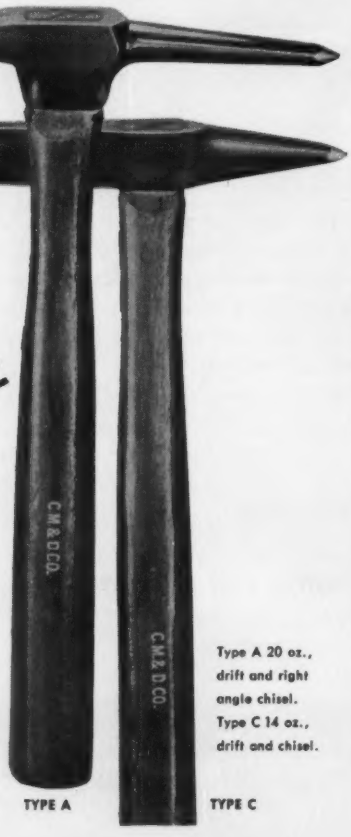


TYPE A

TYPE C

Type A 20 oz., drift and right angle chisel. Type C 14 oz., drift and chisel.

AMA Publishes Book Covering Physical-Distribution Cost

American Management Association, 1515 Broadway, New York 36, has published the book, *Management of the Physical Distribution Function.* This book is a guide for reducing the cost of moving finished goods from the production line to the customer, and consists of three parts. Part 1 shows how to identify and control costs by integrating order handling, inventory control, shipping, traffic, warehousing, and material handling under a single command.

Part 2 describes how common carriers help cut distribution costs, improve service, and maintain quality and availability. Part 3 explains the physical distribution management programs of leading companies. Price of the 200-page book is $3.50 to AMA members and $5.25 to non-members

Circle 623 on Page 39

HERE'S A QUICK CHANGE ARTIST FLEXIBLO®

Flexiblos Are Available In 8 Sizes For Cores Ranging From The Smallest To 500 Lbs.

THE WORLD'S MOST FLEXIBLE CORE BLOWER

Production, semi-production and jobbing core rooms all require speed plus flexibility in core production. Any time not actually devoted to the making of cores adds man hours . . . any machine that is not flexible increases costs. Any wasted time of manpower or machine hurts your competitive position. No wonder a "quick change artist" like B & P's Flexiblo has become a must in today's busy core room.

The Flexiblo's draw accommodates a wide range of boxes without machine adjustments . . . thus saving money by eliminating many non-productive minutes due to job changes. The quick-change blow plate allows the necessary changes to be made in seconds, thus cutting man-hour waste . . . many more core boxes are handled. An easily removable core box clamp provides even more flexibility.

Not only does Flexiblo accommodate the widest range of core boxes, permit the fastest change in the industry today, and accommodate any type of core box, but it also blows any core harder, faster, and at less cost than any other machine.

Flexiblos are B & P designed and engineered for maximum production and minimum maintenance. Your Beardsley & Piper representative is well qualified through training and experience to consult with you about cutting your core room costs. He will be happy to meet with you at your convenience —no obligation, of course.

BEARDSLEY & PIPER
Div. of Pettibone Mulliken Corp.
2424 N. Cicero Ave., Chicago 39, Ill.

Circle 624 on Page 39

Stub at right shows typical waste with conventional cutting carbons; piece at left shows small amount of waste with Kostkutter Rods.

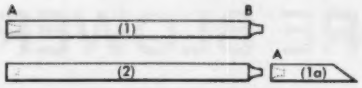
"Speer's new KOSTKUTTER RODS* save us between 18 and 25% over conventional cutting carbons," *says Joseph P. Fucci, General Foreman, Erie Forge & Steel Corporation, Erie, Pa.*

Kostkutter Rods can save *you* money too. Their revolutionary design, a Speer development, allows the joining of the 2½ inches "waste," which would normally be thrown away, to the front of the next rod for further use. Thus, stub loss is virtually eliminated. In addition, Kostkutter Rods make possible further savings by reducing torch damage, since it is no longer necessary to economize by burning carbons close to the clamp. By joining on a new rod, the hot spot can always be kept at a safe distance from the clamping device. The additional "leftover" carbon is used up with the next rod. Kostkutter Rods are copper plated (except the tapered sections) after shaping the rod ends, thus insuring perfect contact between rods.

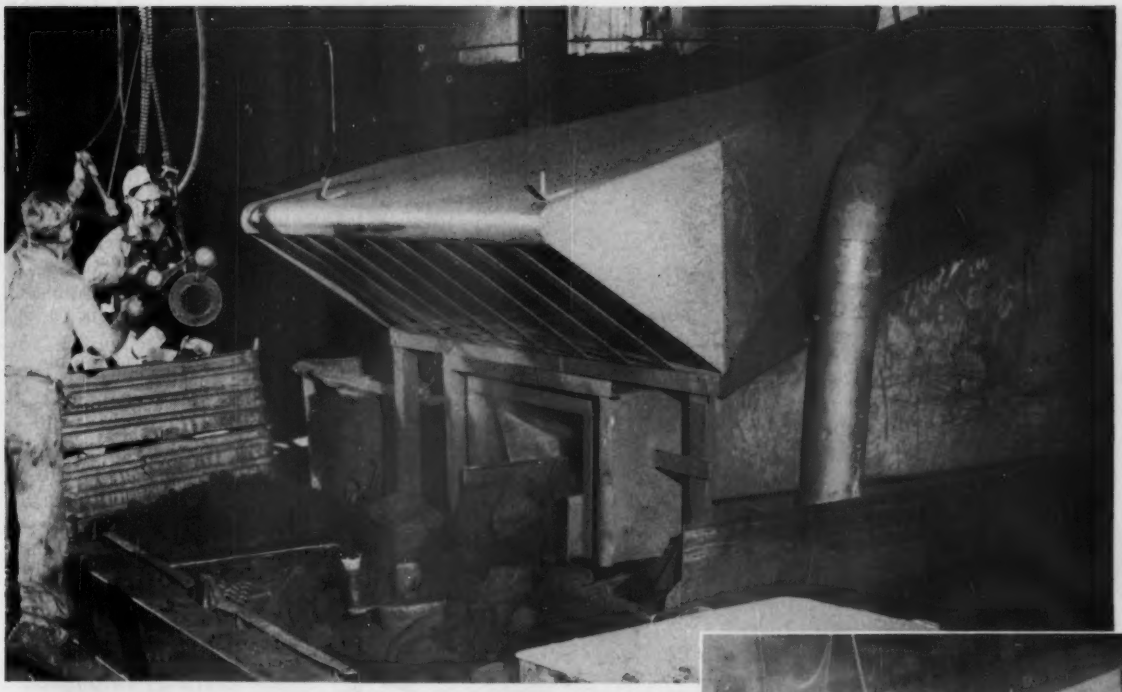
Kostkutter Rods are available only from Speer. Buy them in diameters of ½", ⅝", ¾" and 1". Standard cutting carbons are also available at slightly lower prices. *Patent applied for

How Kostkutter Rods Save You Money

Each Kostkutter Rod has a tapered hole in one end (A) and a tapered projection at the other end (B) as shown in Diagram 1. The rod is clamped into the torch and used in the normal way. The stub end (Diagram 1a) which, with conventional cutting carbons would be wasted, is removed from the torch and attached to the end of a new Kostkutter Rod (Diagram 2). The tapered end of the new rod slips easily into the tapered hole at the end of the stub and is held firmly by friction. The new rod, with the stub attached, is then clamped into the torch and practically the entire stub is used up instead of being discarded.



SPEER Carbon Co
Carbon Products Division · St. Marys, Pa.



DUST COLLECTOR

Helps To Cut Smog

By DAVID PERLIS
Product Manager
Western Precipitation Div.
Joy Mfg. Co., Los Angeles

Above—Top view shows how Dayton Foundry's system draws all dust and fumes into the exhaust duct, cooling air at same time. Lower view shows conditions at shakeout with the system off. Note smoke and dust

● INDUSTRY'S PROGRESS in the fight against air pollution depends on its willingness to install whatever safeguards are necessary. This point is demonstrated by a typical dust collection system installed recently at Dayton Foundry, in Hollydale, Calif., a suburb of Los Angeles.

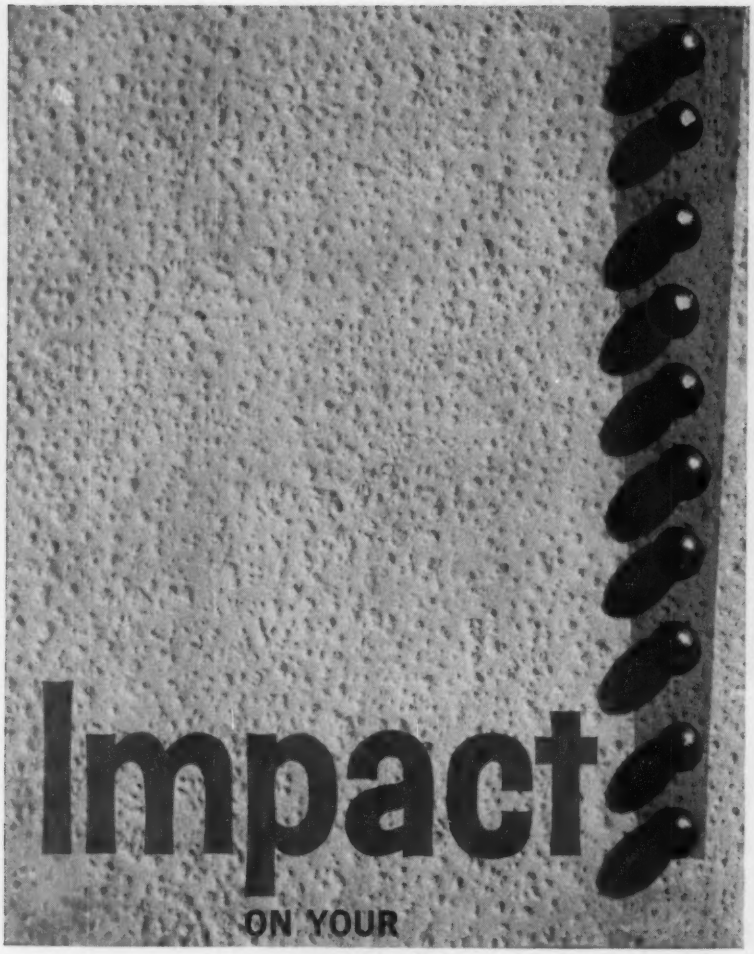
One of the largest in that area, the foundry is situated in the heart of a residential area. As a result, it was imperative that precautions be taken to prevent smoke and fumes from escaping the building. That goal was achieved by the addition of a filtering unit known as the Dualaire, a bag-type dust collector.

A large intake air duct was built directly over the shakeout. Like a giant vacuum cleaner, it picks up smoke fumes and fines while castings are being separated from the molds. A suction fan carries smoke and dust through an enclosed conduit to the filtering device outside. By the time the exhaust air leaves the filter, it is 99.99 per cent pure.

This facility consists of fine felt filtering elements which are kept clean by a reverse-jet principle. When dust builds up on the inside of the cylindrical felt bags, blow rings move over the outside of the filter tubes. The rings move up and down the length of the tubes, emitting a strong jet of air which removes dust from the inside wall and restores the original porosity to the filter. Dust automatically is collected in hopper at the bottom of the tubes gradually.

In addition to complying with

Dust and smoke are carried out through ducts to a filter unit which removes practically all contaminants from the air



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CLEANING AND
PEENING PROBLEMS

We could take a major part of this white space telling you about our recent capital investment to produce high quality, laboratory-controlled, electric furnace steel shot and grit . . . REALSTEEL. As well as all the conventional types and sizes of iron shot and grit. That's our business.

We prefer the impact of a practical service provided by the CMA Counselman. These men are experienced consultants available from our company for technical engineering service. They are quality-control men specializing in, and familiar with, the metallurgical, engineering, and production problems of specific industries . . . steel mills, foundries, enameling plants, forge shops.

The CMA Counselman has spent many years inside the circle of *your* problems. Why not put him on-the-spot today? No obligation. Need more evidence of how they work? Write us.

CLEVELAND is the name and the place for PERSUASIVE ABRASIVES

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local air pollution regulations, the installation improves working conditions in that part of the plant. It not only creates a more hygienic atmosphere, but also keeps the work area cooler. Most castings arrive at the shakeout hot, and the suction keeps temperatures within reasonable limits. A special intake tube leads into the pit beneath the floor.

The collector is an economical "package" unit supplied in single or multiple sections to handle any dust removal requirement. The Dayton Foundry system operates at 15,000 cfm and averages 6 to 8 hours of continuous service daily. It is a compact unit and can be adapted to small areas. Dualaire reverse-jet filters are a product of Western Precipitation Div., Joy Mfg. Co., Los Angeles.

SFSA Publishes 1960 Edition of *Steel Castings Handbook*

The 1960 edition of the *Steel Castings Handbook*, just published by Steel Founders' Society of America, is a complete revision in text and illustrations. It contains the latest technical information on the design, manufacture, and use of steel castings for design engineers, materials engineers, and users of steel castings.

A ten-man committee selected from the membership of the society and headed by W. W. Heimberger, works manager, Buckeye Steel Castings Co., Columbus, Ohio, handled the job of compiling the 680-page volume. Charles W. Briggs, technical and research director, SFSA, is editor of the handbook.

The new book consists of 19 chapters and contains 680 photographs and charts and 100 tables. It is 10 per cent larger than the 1950 edition. Chapters on purchasing and machining steel castings have been added, with a list of definitions of terms relating to the manufacture and use.

The book also includes chapters on the advantages and applications of steel castings, fundamentals of design, patterns, tolerances, properties and physical values, heat treatment principles, welding, manufacturing, testing, inspection, and quality control. For a descriptive folder, write to the Steel Founders' Society of America, 606 Terminal Tower, Cleveland 13, Ohio.

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with **H. V. ADAMS DESIGNED**

HIGH EFFICIENCY FOUNDRY TOOLS

"UNIVERSAL FREE WHEELING"

FOUNDRY SAND RIDDLE

with the Double Eight Vibration

Because of its convenient size, light weight and good riddling capacity it long has been a favorite in the foundry. It also can be used for mixing core sand or for sifting sand directly into molds.

The mechanism is entirely enclosed protecting it from harmful dust and grit.

The main frame is cast in very strong tough aluminum.

It uses quick change ferruled sieves with 20 in. diameter sifting area. There are no loose wires to harm hands.

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WILL GIVE YOU

- **SPEED**
- **ECONOMY**
- **SAFETY**
- **LONGER LIFE**
- **GREATER SIFTING CAPACITY**

Its sturdy one-piece frame and long shaft add to vibration effectiveness. The sealed-in mechanism assures protection of motor and bearings from exposure to dust and grit. This sealed in protection and "Rotoplane's" free-rotary action vastly increase bearing life. No exposed moving parts endanger the operator. Sieves have 20 inches diameter clear sifting area—are mounted in a smooth steel ferrule with no jagged edges to cause dangerous cuts and scratches.

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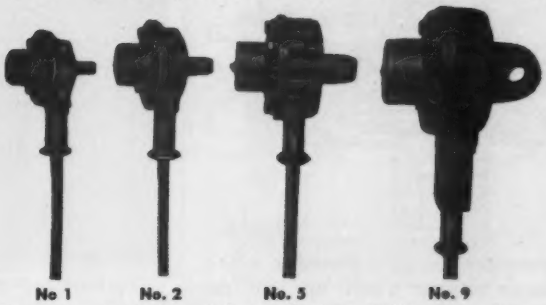

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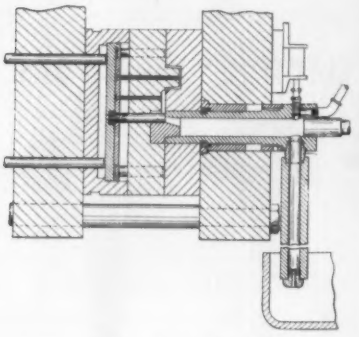
PATENTS

Of Interest to Foundrymen

Diecasting Machine

Arrangement which automatically fills the shot chamber of a diecasting machine and degasifies the metal at the same time is accomplished with suitable electrical controls which operate a valving system to actuate a vacuum line attached to the shot chamber. In turn the shot chamber is connected to the molten metal supply through a small inlet port or metering orifice.

In operation, the valve attached to the evacuating system opens and



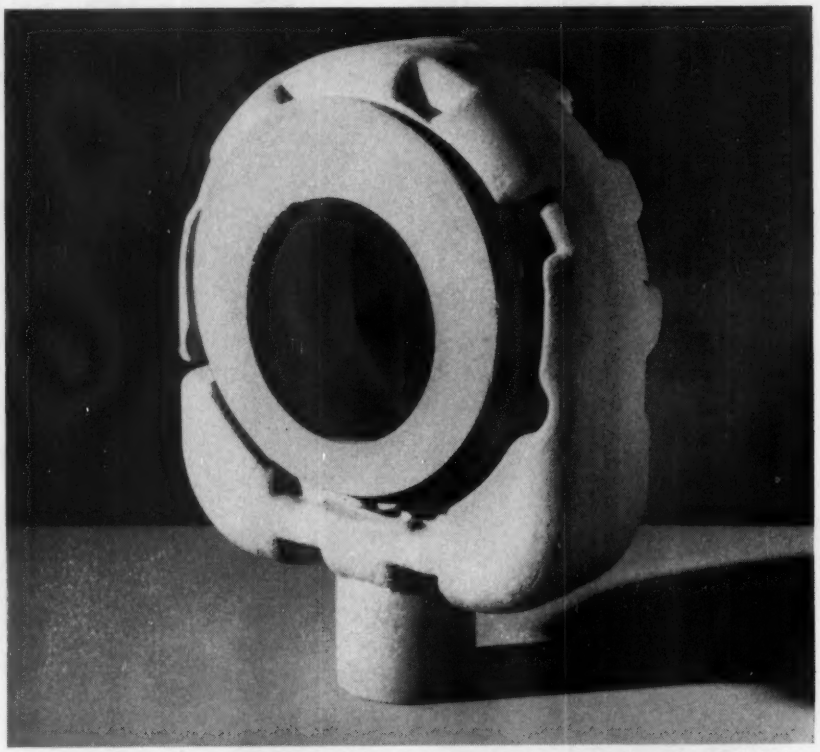
evacuates the shot chamber which draws molten metal up into the chamber. Since the chamber is under subatmospheric pressure, any gases in the metal are withdrawn. The valve is closed, cutting off the metal feed, and then the ram or plunger is actuated to force the metal into the die. *Patent No. 2,955,335 granted to D. M. Morganstern.*

Aluminum Bronze

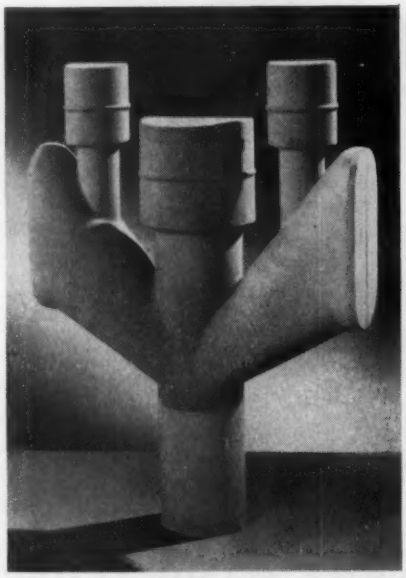
Toughness and wear resistance in aluminum bronze is obtained by additions of cobalt and chromium. A specific composition is given as 15.10 per cent Al, 5.01 per cent Fe, 3.18 per cent Co, 1.50 per cent Cr, and remainder Cu which showed a tensile strength of 100,000 psi, a yield strength of 75,000 psi, an elongation of 1.5 per cent and a Rockwell C hardness of 40 in the chilled state.

The alloy preferably is made by use of a hardener alloy contain-

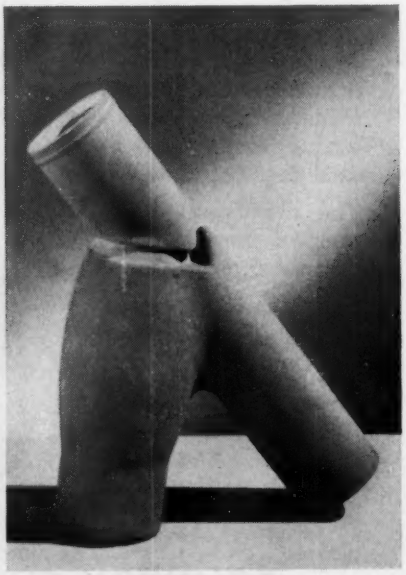
HOW A FOUNDRY SHELL CORES...



"For making a large part the shell process has proved much less expensive than other methods."

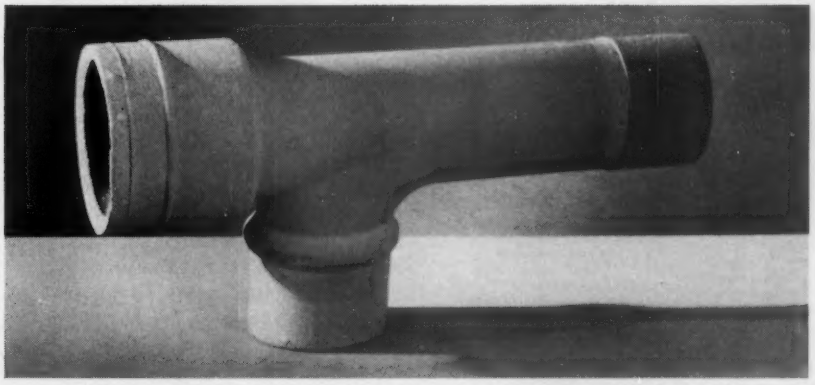


"No handling problems, no knockout problems. And we can stack shell cores."



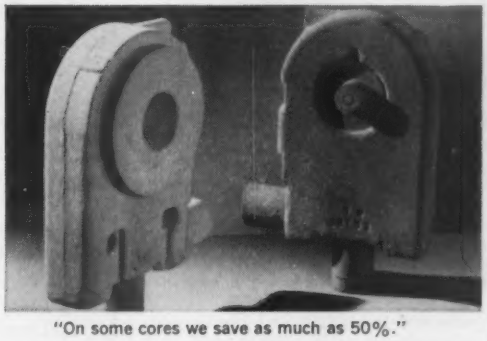
"We use Durez foundry resins 100%. They give us consistency from one order to the next."

FEELS ABOUT AFTER 6 YEARS



"We produce four big cores where we used to produce one—and we do a better job."

MORE CASTINGS BETTER CASTINGS LOWER PRODUCTION COSTS



"On some cores we save as much as 50%."

That's the experience of this long-time user of shell cores bonded with Durez foundry resins.

Men of Hallstead Foundry, Hallstead, Pa., were among the first to start working with shell cores. The foundry produces castings for plumbing and heating equipment, automotive parts, textile components, appliance gears and wheels.

Modern core equipment releases skilled labor for other work. The process makes core rooms and core ovens unnecessary, saving 75% of the space once needed. Hallstead's core operation can work around the clock. That means better use of employees' time.

With Durez resins, this foundry gets coated sand that can be conveyed by air from the muller with no loss in tensile strength. Cores are uniformly strong with low resin content.

You can get results like these, too. Your Durez sales engineer works with foundrymen in your area—shows them how to get *all* the production economies of modern shell molds and cores. Call him in soon. Or write for Durez 32-page "Guide to Shell Molding" and 16-page "Guide to Resin-coated Sand," which contain valuable recommendations on patterns, materials, mixing, temperatures, lubricants, molds, cores.

DUREZ PLASTICS DIVISION

1001 WALCK ROAD, NORTH TONAWANDA, N. Y.

HOOKER CHEMICALS PLASTICS

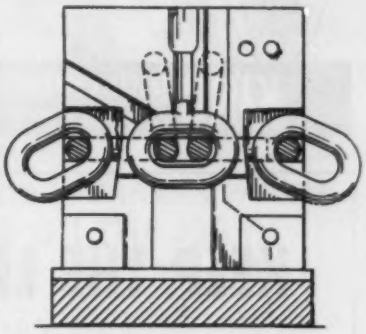
HOOKER CHEMICAL CORPORATION

ing about 45 per cent Al, 20 per cent Cu, 15 per cent Fe, 10 per cent Cr, and 10 per cent Co. To obtain uniform microstructure, the alloy is heated at about 1150° F and held one hour plus one-half hour per inch of section greater than one inch. It is then cooled at a rate faster than 20° F per hour per inch of section which can be obtained conveniently by fan air cooling. *Patent No. 2,944,890 granted to J. F. Klement and assigned to Ampco Metal Inc.*

Permanent Molding

Permanent mold and method for producing cast link chain of aluminum or bronze includes a multi-part mold which can be assembled rapidly prior to casting operation, and also quickly disassembles to free the link after casting.

Mold is in four parts. One lower section is fastened to the base of the



machine, and the others are attached to rams to move in the horizontal direction for opening and closing the several sections. Arrangement also is made so that the mold can be hammered while it is being filled with molten metal and during the period of solidification. Gate attachment to the casting is tapered, with the enlarged end at the casting to insure a solid casting. *Patent No. 2,957,215 granted to J. S. Nelson.*

Investment Molding

Method of building up a ceramic shell for investment casting includes use of a refractory slurry bonded with sodium silicate into which the wax pattern is dipped. Then the wetted pattern is dusted or stuccoed with silica sand, and the assembly gassed with carbon dioxide. This cycle is repeated three times. A

Circle 628 on Page 39

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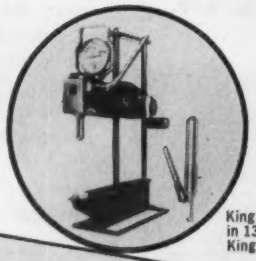
The KING PORTABLE TESTER

King Test Head with Chain Adapter



King Test Head in 13½" base with King Brinell Scope

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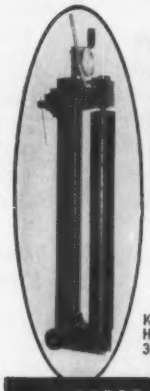

King Test Head in 30" base

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- Gap 10" — 13½" — 30". Throat 4" — 6¾" or larger with chain adapter.
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- Will make tests in places no other tester can reach — including cylinder bores.

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Known the world over for accuracy and dependability

Circle 629 on Page 39

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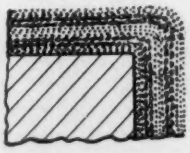
fourth layer of slurry and sand is applied, but instead of gassing the layer is dried in air at the temperature of about 42° C (108° F) for 30 minutes. Three more layers are applied and treated in a similar fashion.

Mold and pattern next are heated over a period of about 7 hours with



temperature increasing from 40 to 60° C to remove moisture and then the temperature is raised to 100° C to melt out the wax. Mold is fired to 900° C (1650° F) and is ready to receive molten metal. *Patent No. 2,945,273 granted to N. Herzmark and A. Leschot; said Leschot assignor to Herzmark.*

Iron-Calcium Alloy

Production of iron-calcium base alloys to be used for improving the physical and chemical properties of iron and steel is accomplished through addition of one or more elements which have a strong affinity for iron and calcium but do not make an alloy or compound with each other. Such elements include nickel, silicon, aluminum, and manganese.

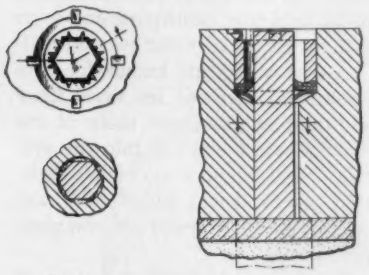
One alloy contains 20 to 40 per cent Ca, 10 to 50 per cent Mn, 5 to 40 per cent Si, and remainder Fe, and another shows 15 to 30 per cent Ca, 10 to 50 per cent Mn, 5 to 20 per cent Al, less than 20 per cent Si, and remainder Fe. *Patent No. 2,950,187 granted to T. Ototani and assigned to Research Institute for Iron, Steel and Other Metals of Tohoku University.*

Metal Mold Vent

In centrifugal casting of tubular metal articles such as cast iron and steel pipes and tubing, using a metal mold lined with refractory materials, it is necessary to provide vents to permit the easy escape of gases generated by the action of the molten metal on the refractory. The vents should be such that they do not permit the escape of the refractory when the molds are made, and that they may be cleaned easily when

they become plugged up after a period of use. Both objects are accomplished by the device shown.

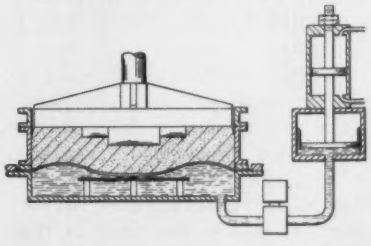
Hole in which the sharp-edged core members are located are larger at the outside periphery of the mold. Core members are held in place with



slotted fasteners, and tops of the members are headed to fit into socket wrenches. That permits turning the core members which loosens any deposits in the spaces formed in the grooves. *Patent No.* 2,956,322 *granted to J. M. Cranford, R. L. Teague and W. H. Wright, and assigned to American Cast Iron Pipe Co.*

Sand Compression Method

Method of packing sand around a pattern in a mold box or flask is shown in the accompanying illustration. In this operation the pattern is mounted on a platen, which in turn is attached to a ram so that it can be forced down into a flask filled with sand. Lower portion of the machine is a hydrostatic container with a diaphragm attached to its upper edges which contains a noncompressible fluid. The con-



tainer also has a center support on which the diaphragm rests.

In operation, the flask is filled with sand, the ram containing the pattern is forced down into the sand in the flask, and then the diaphragm is forced upward to compress the sand further around the pattern. *Patent No.* 2,956,317 *granted to H. P. Peasley.*

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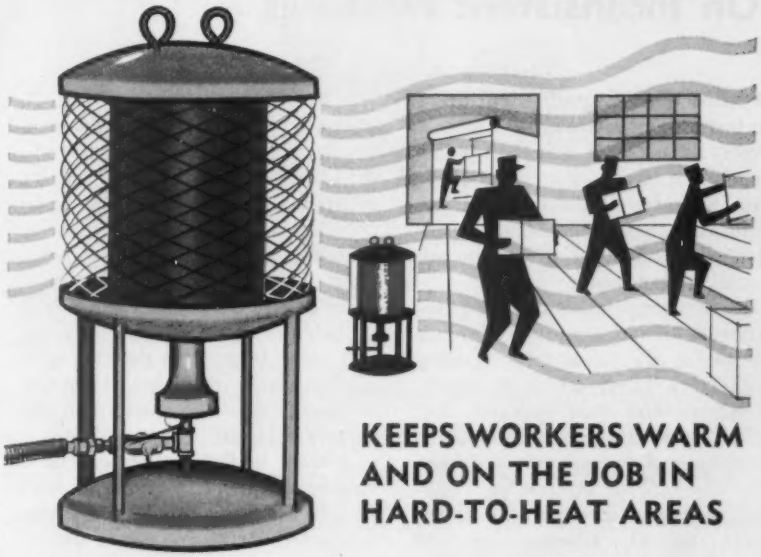
for use in industrial and commercial buildings



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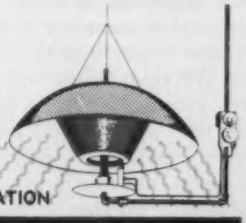
Space-Ray high capacity portable heaters beam warm infra-red rays out over the lower working level of buildings to heat men, floors, machinery and tools. Easily moved in minutes to new location for spot or supplemental heat. Large cylindrical stainless steel heat exchanger radiates more infra-red heat over a wider circular area than any portable heater of similar BTU input. Space-Ray low cost heaters operate on natural or LP gas, need no electricity ... no fans or blowers to stir up dust. Has 100% automatic shut-off valve for maximum safety. 50,000 and 100,000 BTU sizes.

OVERHEAD INFRA-RED HEAT

Space-Ray Infra-Red Heaters also available in overhead model for permanent type installation.



WRITE FOR COMPLETE INFORMATION

SPACE-RAY CORPORATION

306 West Tremont Avenue, Charlotte 3, N. C.

The Sandman Says

By HAROLD E. HENDERSON
H. C. Macaulay Foundry Co.
Berkeley, Calif.

"On Inconsistent Mixtures"

● LEMONADE would seem to be an inconsistent mixture. We put in lemon to make it sour and sugar to make it sweet. But when these two contrary elements are in acceptable balance, the result is acclaimed excellent by those who are partial to lemonade.

In an attempt to control the properties of foundry sand, we also run the gamut of inconsistency. Starting with silica sand, which is highly refractory and thus desirable, but of an expansive nature and thus potentially dangerous, we add various amounts of cushioning material, such as wood or corn flour, rice hulls, seacoal, asbestos, etc., to counteract the expected expansion. If we exercise good judgment in our use of this cushion, castings results are satisfactory, and we have what is termed controlled sand.

But if, as often is the fact, we are short on cushioning material, buckles and rat tails appear, and perhaps scabs. If we have been too generous with wood flour additions over an extended period, we may produce a weak, brittle sand which results in drops, stickdowns, washes, and a reasonable facsimile of a scab, even though ramming is not excessive and moisture is low.

A Working Balance—In our efforts to maintain a system sand that will perform reasonably well over a considerable casting range, we resort to various expedients to maintain a working balance. Since it is practically impossible to insure a true condition of equilibrium, we examine our daily casting results in the hope that we may anticipate any trouble and thus prevent it.

The appearance of an expansion streak or rat tail indicates the approach of buckle and the need for more cushioning material and probably less water. Casting color, for example, is a reliable index to judgment in the use of seacoal. Most other defects also inform us of their probable origin and cure. But we still are beset by defects with sources which lie within the realm of speculation. On these, even the experts disagree.

A Case in Point—Let me cite a case in point. The green sand practice in a certain iron foundry was conducted for several years with a minimum of trouble. The base sand was angular, with low silica content (75 per cent) and about 5 per cent weak clay.

With moderate amounts of bentonite, seacoal and wood flour, casting results were satisfactory on a rather wide range of work. Then shipments of the base sand began to show a gradual coarsening, which was reflected adversely in casting finish. Because protests to the supplier were of no avail, and because the condition became aggravated to the point where casting appearance was unacceptable, it was decided that this sand should be discontinued. A much finer and more nearly uniform material then was substituted.

If a finer sand would counteract this coarsening, it seemed reasonable to make a radical departure in the hope of securing immediate results. It was decided that the most likely available sand for this purpose was a No. 120 high silica (98 per cent), rounded grain sand.

Because of the refractory nature of such a sand, it was realized that potential dangers must be recognized. In former experience, the expansive property of high silica had resulted in a rash of buckles when the amount of cushioning material used was inadequate and even a slight excess of water was present.

Armed with this knowledge, the sand man increased his wood flour additions as more and more of the No. 120 sand was fed into the system. Since about a ton of this high-silica material was added daily, the entire system changed its complexion rapidly.

Because of the varying weight of castings poured, it was difficult to determine even the approximate amount of residual wood flour, but casting finish was visibly improved, with no indication of approaching buckle, and the prescribed additions were continued. Then a condition developed which, because it was new at least to this shop, has caused controversy of a most stimulating character.

Lacy Penetration—Cope surfaces of 12 in. or more in extent revealed a type of penetration that had not been encountered previously and seemed to defy definition. Very thin, lacelike or leaflike formations appeared at various points—one or more—from ¼ to 2 in. in extent.

They might have been considered the harbinger of buckle inasmuch as the casting surface was indented to the extent of the thickness of the penetrating metal. This distance, however, seldom was more than 1/64 in. and could be removed easily with a knife blade or even a finger nail.

It hardly could be considered true penetration as we commonly understand the term, for the point of penetration usually was too small to be discerned, and the lacy effect seemed to follow a restricted pattern. It was at first thought that the defect was due to the high expansion of the increased amount of new silica sand and that it could be counteracted with larger doses of wood flour and seacoal.

For a while these additions appeared to be effective, but some surface veining and discoloration occurred. It then was believed that the amount of wood flour might be

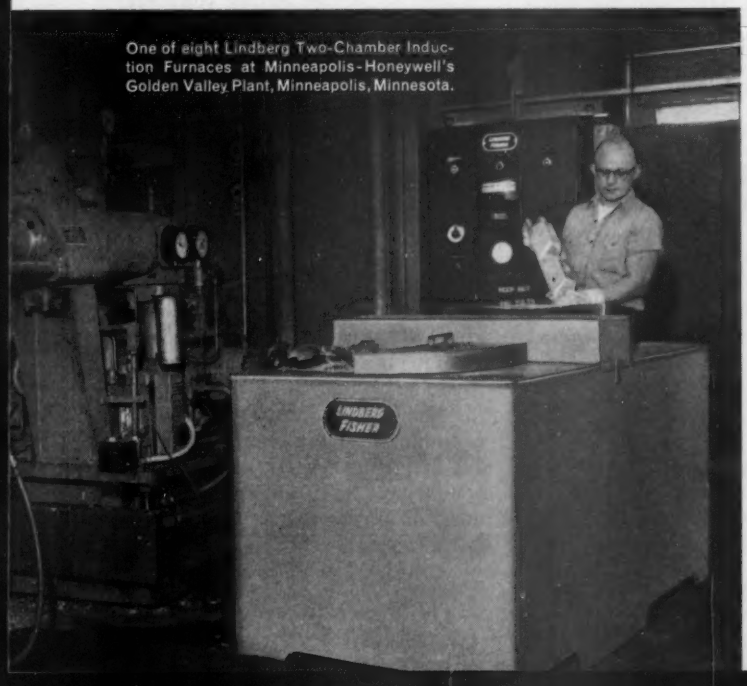
ART GEORGE has a good word to say for Lindberg Melting Furnace performance

QUOTE

Mr. Art George, Senior Production Engineer, Golden Valley Plant, Minneapolis-Honeywell Regulator Company, Minneapolis, Minn.

"Our installation of eight* Lindberg-Fisher Two-Chamber Induction Melting and Holding Furnaces has given remarkable service for more than four years. In this period, with the help of a well executed Honeywell maintenance program, the installation has been unusually trouble-free. Only one of the eight furnaces has required relining over this long period. Handling more than 1,000,000 pounds of aluminum and zinc annually, the installation has unfailingly provided the consistently high quality of metal our precision instruments require."

**Altogether, 44 Lindberg Furnaces are in operation in various Honeywell plants.*



One of eight Lindberg Two-Chamber Induction Furnaces at Minneapolis-Honeywell's Golden Valley Plant, Minneapolis, Minnesota.

These eight Lindberg-Fisher Induction Furnaces melt and hold aluminum and zinc for die casting gas valve housings and other component parts. They are located at the die casting machines where ingot and scrap can be melted and held at the desired casting temperature in one convenient unit. Magnetic fluxing and stirring insures uniform temperatures and consistently clean metal.

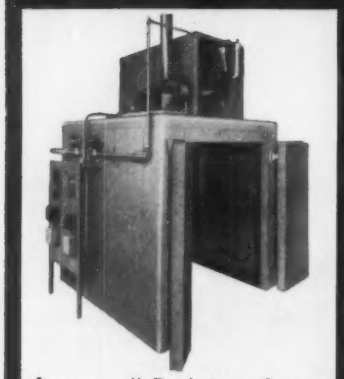
In any production process where aluminum needs heat there is Lindberg equipment to apply it most economically and efficiently. Furnaces for melting and holding, casting stations, re-melting or heat treating are available in all capacities, electric or fuel fired. Get in touch with your Lindberg Field Engineer (see your classified phone book) or write us direct. Lindberg-Fisher Division, Lindberg Engineering Company, 2453 West Hubbard St., Chicago 12, Illinois.

Los Angeles plant: 11937 S. Regentview Avenue, Downey, California. In Canada: Birlefco-Lindberg Ltd., 15 Pelham Ave., Toronto 9, Ont. Also, Lindberg plants in Argentina, Australia, England, France, Italy, Japan, South Africa, Spain, Switzerland and West Germany.

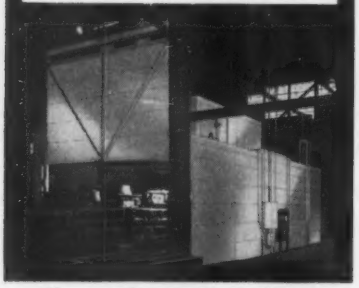
Circle 632 on Page 39

LINDBERG
heat for industry

LANLY heat processing equipment for the FOUNDRY INDUSTRY



from small Rack type Ovens to the BIG CAR TYPE OVENS



If a need arises to replace or improve your Foundry Ovens, it is only logical to look to LANLY, recognized authorities in the design and construction of heat processing equipment for more than 22 years.

TODAY may be the opportune time to survey your present facilities and request the counsel of a LANLY representative at no obligation.

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Circle 635 on Page 39

excessive and thus productive of a gas that could crack the surface just prior to solidification of the metal, creating the lacelike penetration.

Experimental Mixes—In an attempt to learn just what was happening, two sand mixes were made —one with what was considered to be a minimum of wood flour and one with an extra-large amount of this cushioning material. A first inspection at the shakeout showed no perceptible difference between results with the two mixes. After sand blasting, the castings were subjected to a critical examination by several department heads, all of whom agreed that there was little observable difference in the results which were obtained.

This lack of variation would seem to indicate that the lacy defect was not due to either an excess or deficiency of cushioning material. But an element of mystery still remains to be resolved. What was responsible for this unorthodox defect? The inquiry and the debate will continue.

Metal Melting Loss— How Much Does It Cost?

By HAROLD J. ROAST
Bronze Foundry Consultant

A nonferrous foundry melting say 50,000 lb a day and having a metal loss of 3 per cent loses 1500 lb of metal a day. This loss will consist of, first, the most volatile metal, plus a definite but lower loss for all the components.

It is hardly likely that the metal lost will be worth less than 20 cents a lb. In such a case the value of the metal lost by melting will be $300 a day. By the use of the latest modern equipment it should be possible and practicable to reduce the 3 per cent metal melting loss to 1 per cent, thus saving $200 a day or $44,000 a year of 220 days (allowing one month for shutdowns).

The capital outlay will, of course, vary with the type of equipment chosen, as will the number of furnaces needed. A hypothetical example might be taken where two furnaces would be required at a cost of say $85,000. In this instance the new installation would pay for itself in two years, leaving a saving thereafter of $44,000 a year.

Perhaps it would be in order to define a few of the terms used.

By "metal loss" is meant the difference between the metal weighed in as the furnace charge and the weight of molten metal in the furnace ready to pour. The most accurate method of obtaining this figure is to have a ladle of sufficient size to hold all the metal melted. When the charge is ready for pouring, empty the furnace completely into the ladle (the tare of which has been established) and weigh the molten metal plus the ladle on a suitable scale. Divide the difference in weight by the weight of the charge and multiply by 100 for percentage of "metal melting loss."

Cost of Melting—This should be made up of: Cost of fuel—solid, gaseous, or electrical; cost of labor for loading, operating, and pouring into ladle including cost of maintenance of furnaces.

Quality—This should be judged by: Metallographic test for gas inclusions and oxide; specific gravity, as a measure of gas present.

In view of the foregoing, why not take a closer look at your metal melting loss?

Book Review

Vacuum Process in Metalworking, **by J. Wesley Cable, plastic cover, 202 pages, 5¼ x 7⅝ in., published by Reinhold Publishing Corp., 430 Park Ave., New York 22. Price $5.50.**

Following a discussion of the physical state of vacuum and how to produce it, the author considers the various processes which may be performed under vacuum. These processes include heating; outgassing, purification, refining, and distillation; melting and casting; deposition of metals; sintering for powder metallurgy; brazing and welding; and heat treatment.

Vacuum melting is reported as the most widespread application of vacuum technology in the metalworking field. Impetus has been given to the process by the development of high-capacity, low-pressure pumping systems, and the demand for higher temperature alloys with a minimum of contaminating gaseous impurities. Construction of the equipment and accessories, and methods of operation also are discussed.

Knight LETTER

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Subject: Foundry Mechanization

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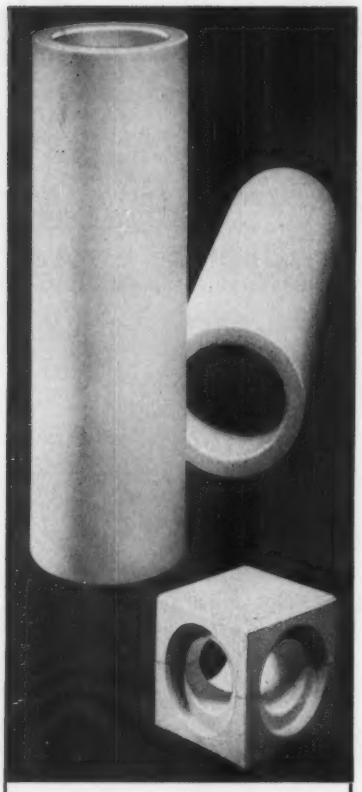

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Circle 633 on Page 39

MALLEABLE FOUNDERS MEET IN CLEVELAND

Discuss Depreciation Reform, Business Outlook

● MARKETS, depreciation reform, and the economic outlook for 1961 were discussed at the semiannual meeting of the Malleable Founders' Society, held Dec. 2 in Cleveland.

The MFS meeting was preceded by a breakfast at which members of the Malleable Castings Council discussed the 1961 advertising program and heard a talk on merchandising followup by Loren Seager, Carr Liggett Advertising Inc. Mr. Seager pointed out a variety of ways in which individual members could get the most mileage out of the council's national advertising.

C. P. Speitel, Pennsylvania Malleable Iron Corp., MFS president, opened the regular meeting with a number of announcements.

Technical Director Hans J. Heine reported that the annual Technical & Operating Conference will be held in Cleveland, March 1-2, at the Pick-Carter Hotel.

Subjects to be covered include the society's fundamental research project at Purdue University, position of supervisors in the management team, design of experiments, new developments in the foundry industry, gating, joining, and other subjects. Mr. Heine suggested that attendance at the conference is of both great interest and importance to members of the society.

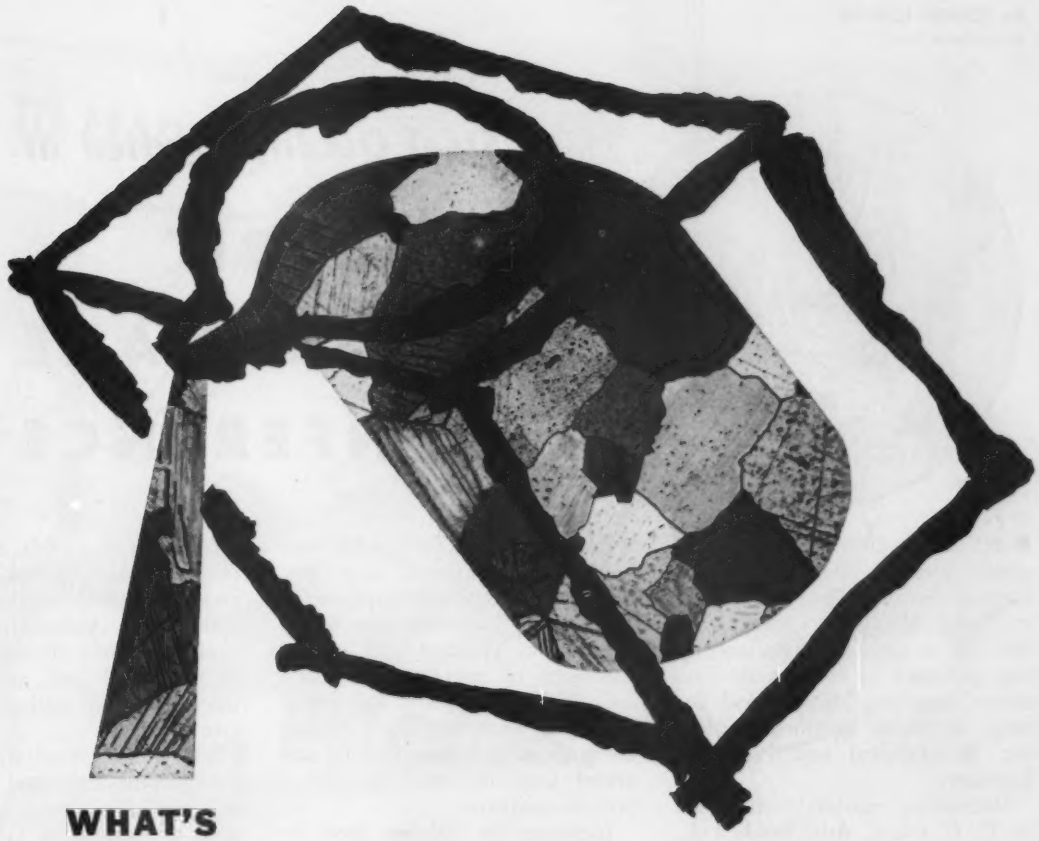
Donald B. Sanberg, MFS administrative director, discussed the 1961 business outlook. Prospects for malleable castings producers are neither particularly good nor bad. The great postwar boom in durable goods seems to be over, and concepts of normal volume may require revision.

"Depreciation Reform in 1961" was discussed by John R. Morgan, associate managing editor, *Steel*. Mr. Morgan stated that U. S. depreciation laws are the most backward in the world. Since 1934, American industry has underdepreciated its facilities and has overstated profits by $6 billion, on which it has paid taxes. In addition, long-term depreciation creates a tendency for industry to hang onto equipment even though it is obsolete and makes foreign competition more difficult to meet. Effective reform depends on agreement of industry as to what new system it prefers and on the pressure brought to bear on Congress to enact legislation.

Other features of the meeting included a showing of the new Gray Iron Founders' Society film "Rice Bowls to Rockets" and a roundup of the publicity activities of MFS by Edward F. Kelly, MFS public relations director.

To close the meeting, members reported on business activities and the labor situation in their respective parts of the country.

Left to right, Joseph Gutenkunst, Milwaukee Malleable & Gray Iron Works, president, Malleable Castings Council; Charles P. Speitel, Pennsylvania Malleable Iron Corp., president, Malleable Founders' Society; and Roy C. Hobson, National Malleable & Steel Castings Co., a director of MFS



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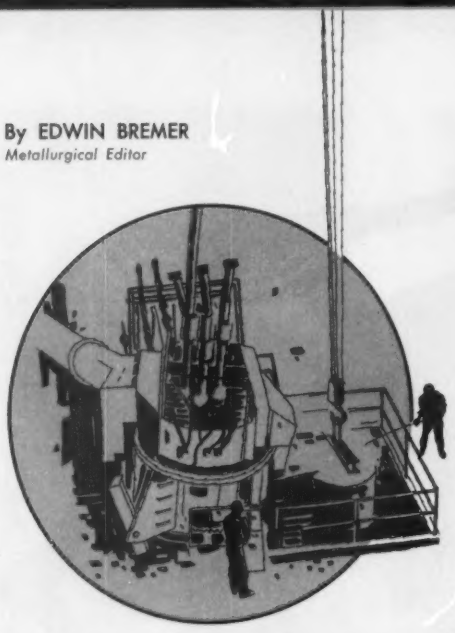
INDUCTOTHERM

By EDWIN BREMER
Metallurgical Editor



Steel Quality Studied at

ELECTRIC FURNACE CONFERENCE

● NEARLY 1000 members and guests attended the 18th annual Electric Furnace Conference held at Hotel Morrison, Chicago, on Nov. 30 to Dec. 2. The meeting was sponsored by the Electric Furnace Committee, Metallurgical Society, American Institute of Mining, Metallurgical and Petroleum Engineers.

Welcoming remarks were made by G. C. Olson, Atlas Steels Ltd., Welland, Ont., and chairman of the conference. P. R. Gouwens, Armour Research Foundation, Chicago, and chairman of the Electric Furnace Executive Committee, announced that Mr. Olson had been elected chairman of the executive committee for 1961, and that C. G. Mickelson, American Steel Foundries, East Chicago, Ind., had been elected chairman of the committee of the 19th conference to be held at the Penn-Sheraton Hotel, Pittsburgh, on Dec. 6-8.

Frank St. Vincent, Interlake Iron Corp., Beverly, Ohio, was elected first vice chairman and R. W. Farley, Republic Steel Corp., Chicago, was made second vice chairman.

At a joint session of ingot and casting producers, nonmetallic inclusions in steel were discussed by several speakers. **Techniques for the Study of Nonmetallic Inclusions** by W. D. Forgeng, Union Carbide Metals Co., Niagara Falls, N. Y. indicated that there are two types of inclusions, indigenous and exogenous. Indigenous type includes sulfides, oxides, nitrides, and carbides, and may be distinguished by their small size and homogenous distribution.

Exogenous type, formed by reaction with refractories, slags, etc., usually are large and haphazardly distributed. Inclusions may be examined on polished and etched specimens of steel microscopically under different types of lighting to determine what they are. If they are large enough they may be separated from the steel by use of bromine methanol.

Inclusions in Stainless Steel by D. C. McCarter, S. Ramachandran, and J. C. Fulton, Allegheny Ludlum Steel Corp., Brackenridge, Pa., was presented by Mr. McCarter. Exogenous inclusions result in marred or defective sheets, and studies using zirconium, cobalt, barium and strontium tracers in the ladle refractories indicate that they are responsible for about 15 per cent of the defective sheet steel.

Inclusions in High-Temperature Alloys and Ferritic Steels by Alexander Nagy and W. J. Pennington, Universal - Cyclops Steel Corp., Bridgeville, Pa., was presented by Mr. Nagy. In vacuum-consumable electrode arc melting of ferritic steel for bearings, sulfide inclusions are not affected. Alumina inclusions can be lowered, globular oxides can be decreased markedly, and there is a decided effect on silicate inclusions. Use of clean electrode material gives improved ductility in the steel. With high-temperature alloys, vacuum arc melting places carbides and nitrides on the periphery of the ingot.

Quantitative Extraction of Nonmetallic Inclusions from Steel by H. Walz and R. A. Bloom, Timken Roller Bearing Co., Canton, Ohio, was presented by Mr. Bloom. He described a combined electrolytic and chlorination method for separating the inclusions from the steel. Amounts of residue extracted are small and require microspectrochemical methods for analysis.

The session closed with a paper, **Petrographic Tools and Techniques in Examining Nonmetallic Inclusions in Steel** by R. G. Wells and J. M. Snook, Crucible Steel Co. of America, Pittsburgh, which was presented by Dr. Clifford McCoy, of the same firm.

At a session on control of nonmetallics in steel for castings, four papers described different procedures. **Treatment of Steel with Magnesium To Ease the Sulfur Problem** was discussed by W. B. Brooks, Dow Chemical Co., Freeport, Tex. Satisfactory reduction of sulfur in steel melted in a basic-lined induction furnace was accomplished by injection of a mixture of 4 parts lime and 1 part magnesium with argon gas as the carrier. Steel is dead-melted with a fairly high carbon, and then treated without any trouble. After desulfurization is completed, the slag is removed. Cost of the treatment was said to be about $3 a ton.

Vacuum Degassing of 500-lb Melts for Carbon Steel Castings by D. E. Parsons, Department of Mines and Technical Surveys, Ottawa, Ont. Vacuum spray and ladle degassing decreased hydrogen to 1.0 to 1.5 ppm and oxygen to 33 ppm. Degassed castings had fine-grained, equiaxed macrostructures. Zone of last frozen metal

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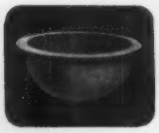

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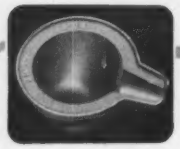

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Circle 638 on Page 39

(porous area) normally present at center of the casting was displaced to a location about ½ to 1 in. from the mold wall in 4-in. sections. Full ductility was maintained in 4-in. sections with the hydrogen below 1.5 ppm, and at higher hydrogen levels full ductility was restored by a 70-hr bake at 400° F.

Pressure Pouring of Steel Castings by Thomas Quinn Jr., Lebanon Steel Foundries, Lebanon, Pa., was presented by S. E. Wolosin of the same firm. In this method the molten steel is forced slowly and uniformly into the mold cavity from below by air pressure applied over the surface of steel in a ladle. A refractory tube immersed in the steel conveys the metal into the mold cavity. Developed by Griffin Wheel Co., the process is similar to that used for steel carwheel production but uses green sand instead of graphite for molds.

John McBroom, Stainless Foundries & Engineering Co. Inc., Milwaukee, discussed **Desulfurizing Steel Under Production Conditions.** It related to 1000-lb heats melted in basic-lined electric arc furnace. Alloys included 347 stainless, and other high-alloy steels, Monel metal, Illium G, etc. The steel was melted down under a lime slag and temperature raised to 2950° F. That slag is removed, and the metal deoxidized by plunging in 1 lb of aluminum per ton.

Next a prepared slag-forming mixture of 15 parts calcium carbide and 5 parts metallic silicon fines is added. That is rabbled into the bath with a wood paddle for 10 minutes, and then removed to prevent reversion of sulfur from slag to metal. The metal bath finally is blown with oxygen to obtain desired carbon; content of 0.01 C can be obtained easily.

Refining steel in induction furnaces exposed to the atmosphere was considered by eight speakers. **Manganese-Silicon Ratio in Air Induction Melting of Stainless Steel** by J. Fuqua, Cooper Alloy Corp., Hillside, N. J., pertained to practice for steel poured into shell molds which tends to have pock-marked surface and pickup of carbon on surface. Raw material is carbon-free Swedish iron with 1.5 per cent Ni oxide and 1.5 to 2.0 per cent FeSi. Mn level is held to below 0.20 per cent, and the silicon to 5 times the Mn. Alloy is brought to 2900° F which starts a silicon boil since there is no carbon present. Practice results in castings with surfaces free from carbon.

Slag Compositions Used in Air Induction Melting by W. W. Moore and N. H. Keyser, Battelle Memorial Institute, Columbus, Ohio, and presented by Mr. Keyser, related to special cases where desulfurization, and nitrogen and hydrogen pickup are important. One slag contained 51 alumina, 42 lime, and 7 magnesia with a melting point of about 2450° F. Mixture is calcined at 1600° F and placed in sealed cans until used.

Production of Low-gas Content Metal Using Argon Atmosphere by Elwood Bowen, Ohio Steel Foundries, Springfield, Ohio, was presented by Ray Fleming of the same firm. In a zircon-lined furnace, argon was used to flush out the air prior to placing the charge in the crucible, and then the melting was conducted under a cover of argon at 20 to 30 cu ft per hour. Use of argon did not appear to affect hydrogen pickup, which varied according to the absolute humidity, being high with high humidity.

Oxidation Behavior in High-alloy Air Induction Melting and Control with Argon Blanket by Thomas Watmough and P. R. Gouwens, Armour Research Foundation, Chicago, was presented by Mr. Watmough. In an underpowered furnace requiring long heat time, use of an argon blanket prevents oxidation problems.

Oxygen Boil in Air Induction Melting by Richard Atkinson, Carpenter Steel Co., Portland, Oreg. The practice is used for small and experimental heats. After melting, 10 lb FeMn is added to the heat, which then is boiled with oxygen and followed by addition of 10 lb FeSi. Composition is adjusted and the heat deoxidized with CaSi.

Desulfurization of Induction Melted Plain Carbon and Low-alloy Steels by C. H. Lumpp, American Steel Foundries, East Chicago, Ind. Use of a slag-forming mixture composed of 10 parts lime and 1 part fluorspar placed on the cold charge in the amount of 2 to 3 per cent permitted reduction of S to 0.010 per cent and lower.

Reduction of C, S, and P Through Oxidation in Air Induc-

tion Melting by Leroy Fink, Electric Steel Foundry Co., Portland, Oreg., was presented by L. J. Venne of the same firm. Carbon is reduced by use of iron or chromium ore or gaseous oxygen while sulfur is reduced an average of 0.008 per cent through use of high lime slag. As yet nothing has been achieved in phosphorus reduction.

Optimum Desulfurization and Dephosphorization in Air Induction Melting by John Zotos, Northeastern University, Boston, and David Colling, Watertown Arsenal, Watertown, Mass., was presented by Prof. Zotos. Desulfurization in a basic-lined furnace is accomplished by refining highly deoxidized steel under a highly basic fluid slag. Inoculation with calcium-base alloys enhances the reactions. Dephorsphorization results from processing a highly oxidized steel bath under a highly basic, oxidizing slag.

In a session on new developments, V. J. Howard, Oklahoma Steel Castings Co., Tulsa, Okla., discussed **Auxiliary Meltdown Torch in the Electric Furnace.** Torch or burner uses oxygen and natural gas and results in saving of 10 minutes per heat, production of 17 lb more per minute, and reduces power 55 kw per ton. Plant cost also is reduced 10 man-hours per ton of steel.

New Developments in Analysis of Carbon and Sulfur by Elliott DuBois, Baird Atomics, Cambridge, Mass., and presented by R. D. Thieme, described use of infrared spectrometer for determination of S as SO_2 and C as CO_2. Use of a vacuum chamber in the spectrograph permits determination of phosphorus, sulfur and carbon.

John Kelley, Steel Co. of Canada Ltd., Hamilton, Ont., discused **Use of the Quantovac in Rapid Analysis.** Device is a spectrograph using a vacuum chamber, photoelectric tubes, and recording instruments to indicate the quantities of various elements present.

Session was concluded with discussions on future possibilities in melting by John F. Elliott, Massachusetts Institute of Technology, Cambridge, Mass.; N. H. Keyser, Battelle Memorial Institute, Columbus, Ohio, and P. R. Gouwens, Armour Research Foundation, Chicago.

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Partial view of the audience at a session of the congress. More than 500 persons registered for the congress, and several hundred attended each session

Technical Reports at the

Die Casting Exposition and Congress

Here are resumes of all 31 technical papers presented at the first National Die Casting Congress & Exposition. They cover die design and building, vacuum diecasting, metallurgy, and other subjects

● A TOTAL of 31 papers was presented at the first National Die Casting Exposition and Congress, held in Detroit, Nov. 8-11.

Subjects covered were based on a survey of diecasters to determine what areas were of greatest interest. They included die design, die building, metallurgical developments, future applications of diecastings, competition to diecasting, cost and profit, quality control, and vacuum diecasting.

More than 500 persons registered for the congress, and several hundred heard each session.

Die Design

Mathematical Determination of Die Design—by John Caster, Research Staff, Syracuse University Research Foundation. Design of a diecasting die or mold involves three technological areas: 1. Mechanical aspects of the die. 2. Thermodynamics of the process. 3. The hydraulic aspect of die design. This paper covers the third of these factors.

An analysis which takes into account most of the variables is available, but thorough analysis of each die design at present seems prohibitive. There may, however, be a suitable simplification based on the full analysis, as follows:

$$W = K A_g \sqrt{P_o f_k / f_o}$$

where W = weight of casting; K = a constant accounting for nozzle constant, time of fill, 2/3 acceleration due to gravity, and density of fluid; A_g = area of gate; P_o = accumulator pressure; f_k = area of plunger; and f_o = area of piston. Simplifying assumptions include that the pressure drop across the gate is one-third of the static metal pressure and that the nozzle constant is 0.6.

The formula thus shows a linear relationship between weight of casting and the product obtained when the gate area is multiplied by the square root of the accumulator pressure adjusted by the mechanical advantage of the plunger-piston combination.

Some Relationships between Aluminum Diecasting Design and Gating Variables—by John Lapin and Richard V. Stumph, Die Casting Operations, Central Foundry Div., General Motors Corp. Many production castings were examined with regard to casting quality limits and the relationship of casting quality to the gate and its associated variable elements. Certain relationships were particularly prominent: 1. Wall thickness vs casting filling time. 2. Casting weight vs gate area. 3. Length of casting (distance from gate to farthest extremity) vs gate velocity.

1. It was found that casting filling time varies approximately as the square of the wall thickness.

2. Gate area was found to be a straight-line function of casting weight. A gate area of 0.390 in.^{2} was required for a 10-lb casting. From this the empirical relation between gate area and casting weight may be expressed as follows:

$$A_g = 0.035\ W + 0.05$$

where A_g is gate area (in.^{2}) and W is casting weight (pounds).

3. Relationship, for a given wall thickness, between gate velocity and

the maximum distance from the gate to the extremity of the casting to be filled may be expressed as follows:

$$V_g = 0.151 \times L_c/T_w^2$$

where V_g is gate velocity (feet per second), L_c is length of casting from gate (inches), and T_w is wall thickness (inches).

A Case Study in Die Design for Aluminum and Magnesium Diecasting—by Matthew McIntyre, McCulloch Corp. At McCulloch, co-operation between manufacturing engineering and the product engineering staff makes possible production of tools and dies which have a continuity of use for more than one model year.

When the engineering staff has prepared its first design concept of a new product, blueprints of the assembly layouts and detail drawings are brought to a joint meeting with the manufacturing engineering group. At that time, the estimated annual market figure and the number of years the basic design will be manufactured are established. It is understood that annual model changes will follow. All prototype drawings then are conveyed to the manufacturing engineering department for producibility study.

Next, the chief diecast engineer and the manufacturing methods engineers prepare a cost estimate and proposed preliminary operations sheet. Liaison between product and methods engineers then is started. Considerable effort is expended to meet the design concept of the engineering staff and to acquaint its personnel with the manufacturing group's recommendations for ease of manufacture and suitability for fabrication with shop facilities. To illustrate the process, the author described the development of a cylinder crankcase.

McCulloch operates 22 diecasting machines with locking capacities ranging from 150 to 1000 tons. The company uses 600 tons of magnesium and 1800 tons of aluminum annually.

Die Building

Mold Fabrication — Cost Reduction and Control—by Rolf H. Berg, Atols Tool & Mold Corp. Reduction and control of mold fabrication cost require consideration of three main areas: 1. Mold making costs affected by the product's design requirements. 2. Costs incurred as a result of the mold design. 3. Costs resulting from the methods and procedures planned for actual construction of the mold.

Lack of co-operation between the product designer on the one hand and the diecaster, die designer, and mold builder on the other may result in an over or underdesigned diecasting, a casting which requires needlessly expensive finishing operations, or an over or underdesigned die. Design of a die should be established on paper before any steel is cut. After that, the mold building shop should control and reduce the direct labor hours needed for the job. One such system was described as an example.

AISI H-13 Steel as Used in the Diecasting Industry—by Arthur E. Scholz, Crucible Steel Co. of America. Requisites of a diecasting die steel include the following properties: 1. Freedom from internal defects. 2. Machinability and polishability. 3. Strength and toughness. 4. Stability in heat treatment. 5. Weldability. 6. Resistance to erosion and heat checking.

AISI H-13 hot work tool steel provides a good combination of these properties and is by far the most popular steel used for aluminum, magnesium, and long-run zinc diecasting dies. Its chemical analysis, in percentages, is C, 0.35; Mn, 0.40; P, 0.025 max; S, 0.025 max; Si, 1.10; Cr, 5.00; V, 1.00; and Mo, 1.50. The amounts of manganese, phosphorus, sulfur, and silicon are not specified by AISI.

The analysis itself does not assure that a material will make a good diecasting tool. A combination of analysis, melting and pouring practices, hot working practices employed to reduce the ingot to a bar or forging, and the heat treatment determines the properties and characteristics of the steel.

Temperature Related to Molds and Casting Properties—by Ross Dean, Sterling Inc. Die temperature control consists of keeping a die at the best temperature for maximum production of parts of acceptable and consistent quality. Efficient control must provide a source of heat, a source of cooling, and proper control for each.

Heat can be provided by an exterior source, such as an open flame or torch, strip heaters, and infrared heaters or internally by electric heaters. Cooling is accomplished by the flow of water through channels. The use of liquid heat circulating through channels throughout the entire die provides a soaking of the complete die block at uniform temperatures, eliminates the hazard of hot spots, and permits close control of area temperatures. Obtaining satisfactory heat transfer during the heat-up period requires that the fluid be hotter than the die. When it is desirable to cool the die, obviously the temperature of the liquid must be lower than that of the die.

Metallurgical Developments

Studies on the Influence of Gas Content, Pressure, and Magnesium Content on the Mechanical Properties of Aluminum Diecastings—by Dr. Werner Ruegg, Injecta Ltd. Tests were conducted with primary alloy ingot of this composition, by percentages: Si, 8.5; Mn, 0.5; Fe, 0.2; and Cu, 0.03, balance Al.

Statistical evaluation of the results led to the conclusion that hydrogen content of aluminum alloys is not a significant influence on mechanical properties of diecastings. Mechanical behavior depends more on diecasting process variables, die design, and composition of the alloy than on gas content. Addition of 0.4 per cent magnesium increased tensile strength of the alloy 9 per cent and yield strength 30 per cent.

Alloy Control for Zinc Diecastings—by J. L. Kimberley and Ernest W. Horvick, American Zinc Institute. Zinc diecasting alloys are highly sensitive to variations in chemical composition. Unless control of the composition is properly established and administered, all other controls or safeguards may prove to be of secondary importance.

The two zinc alloys in use differ only in their copper content. In one, copper is held to 0.25 per cent max, whereas in the other it ranges from 0.75 to 1.25 per cent. Other constituents are, by percentages, as follow: Al, 3.5-4.3; Mg. 0.03 to 0.08; Fe, 0.100 max; Pb, 0.007 max; Cd, 0.005 max; Sn, 0.005 max; Ni, 0.02; Cr, 0.02; Si, 0.035; Mn, about 0.5. Control is necessary because intercrystalline corrosion of zinc diecastings occurs when magnesium is lack-

"HOEGANAES Grade 'A' Melting Stock means easier handling - - with cleaner melting"

Illustration, top left, are units for melting by induction at Pacific-Southern Foundries plant at Bakersfield, Calif.

states Pacific-Southern Foundries, Inc.

Mr. Paul Dawson, Metallurgist of Pacific-Southern Foundries, Inc., Bakersfield, Calif., a subsidiary of Pacific Valves, Inc., Long Beach, Calif., pointed out that these two production advantages alone mean controlled production in Pacific-Southern's plant. But—there are other advantages offered by Hoeganaes Grade "A" Melting Stock, which Mr. Dawson also points out:

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or impurities (lead, tin, and cadmium) are too high. Practical control is possible at reasonable costs.

Aluminum Metal Handling and Control for Diecastings—by F. William Foss, Apex Smelting Co. Each diecaster should purchase ingot to a particular specification, and he should write up a metal handling procedure for his own operation. Both should be followed consistently, but necessary changes should be made as the need is determined. When a problem is encountered, an accurate identification of the defect should be made so that a correct solution can be obtained.

Increased metal temperatures and proper agitation of the melt definitely are beneficial. The selection and use of a good flux is a complement to good melting procedures, and use of an "end-point" flux is recommended. In setting up his procedures and specifications and in solving his problems, the diecaster should use the technical services of his venders.

Metallography of Diecasting Defects—by G. L. Armstrong, U. S. Reduction Co. and R. H. Harder, Lukens Aluminum Co. Elimination of repetitious defects in diecasting requires accurate identification of the defects when they first appear. Use of the metallograph for microscopic examination of the surfaces of a sectioned casting aids such identification. The results of metallographic analysis enable the diecaster to make necessary adjustments in metal and machine conditions to restore the casting cycle to desired efficiency.

The metallograph will reveal whether porosity, shrinkage, die lubricant entrapment, coldshuts, or nonmetallic or metallic inclusions are responsible for a defect. Once the cause has been determined, it is possible to take the proper steps to eliminate repetition of the defect.

Plating and Anodizing of Aluminum Diecastings — by Robert H. Harder, Lukens Aluminum Co. Plating and anodizing of aluminum diecastings offer new product lines to jobbing diecasters, but certain fundamental principles must be adhered to if successful castings of this type are to be produced.

Nonadherence of plating is caused mainly by the presence of nonmetallic inclusions in the castings. Correction of this problem requires proper fluxing, clean metal, and the elimination of unvolatilized hydrocarbons in the solvent. The other important cause of rejects is uneven sheen and surface, which results from the segregation of alloying elements in the holding pot.

Production of anodized castings currently involves the use of magnesium-aluminum alloys or a virtually pure aluminum. The first, however, does not produce a clear finish, and the second is extremely difficult to cast. Aluminum alloys which contain 3.5-5 per cent zinc, 1.5-2.5 per cent copper, and 0.75-1.5 per cent iron offer the best potential. Since the major elements, zinc and copper, are in solid solution, the casting may be treated like pure aluminum. Alloys of this family exhibit excellent fluidity and overall foundry characteristics. Some casting problems occur, but they are not insurmountable.

What's Ahead in Diecasting

Aluminum in the Automobile Engine—by P. R. Kalischer, *Precision Metal Molding*. Use of aluminum castings as major components of automobiles is not a recent development. Actually, the first such use of aluminum castings was made about 1899 when the Berg was built with a cast aluminum crankcase and oil pan. Since the beginning of the 20th century, the use of cast aluminum engine components has increased with the growth of the automobile industry.

The first American car to do so since the Peerless in 1932, however, is the 1960 Corvair, which uses a crankcase and heads made of aluminum by low pressure permanent molding. The 1961 Buick, Oldsmobile, and Pontiac (the latter as an option) compacts use a V-8 aluminum engine made in permanent molds, and the 1961 Rambler Classic Six uses an inline 6-cylinder diecast aluminum block. Chief advantage is weight reduction.

Within 5 years, about 4 million cars per year will be produced with aluminum cylinder blocks and probably aluminum cylinder heads. Most will be diecast—particularly the blocks.

Diecast Engine Design for the European Market—By G. Triulzi, A. Triulzi S.A.S. The first European country to attempt diecasting of automobile blocks is Russia, which will have a 4-cylinder engine block die ready by the end of 1960. This block will be water cooled, of 2.5 litre capacity (about 152.5 cu in. displacement), with sleeves inserted after casting. It will be made on a 2500-ton locking capacity machine made by Triulzi, and metal will be supplied by a reverberatory furnace with automatic ladling. Electrohydraulic equipment will unload the casting from the die and convey it to machining. The design for an 8-cylinder block also is being carried out. The Russians already have made aluminum diecastings weighing up to 35 lb.

The First Watercooled, Diecast, 6-Cylinder Automobile Engine Block—by A. F. Bauer, Doehler-Jarvis Div., National Lead Co. (See p. 144, FOUNDRY, November, 1960, for some details about this engine.)

Sound Diecasting with Sound — by John E. Weber, Southern Die Casting & Engineering Co., and Earle W. Rearwin, Reed-Prentice Div., Package Machinery Co. Experiments in the application of sound waves to diecasting were begun about six years ago in this country. They have involved the use of both audible frequencies, under 20,000 cps, and inaudible, over 20,000 cps. Equipment has been developed to exploit the prticular advantages of both types, but as of now the audible, or sonic, approach appears to be farther advanced and may offer the greater potential.

Both sonic and ultrasonic techniques have proved useful in expanding the scope of application of the diecasting process. Casting designs previously considered impossible have been produced efficiently by use of the proper vibration procedures. Applied effectively, these procedures also may yield greatly improved mechanical properties and surface finish.

Competition to Diecasting

The Competitive Aspects of the Permanent Mold Process—by Frank S. Ross, Permanent Mold Die Co. The permanent mold process is flexible and can be applied in many different ways for the manufacture of either ferrous or nonferrous castings. It is particularly useful in the production of nonferrous castings which require such characteristics

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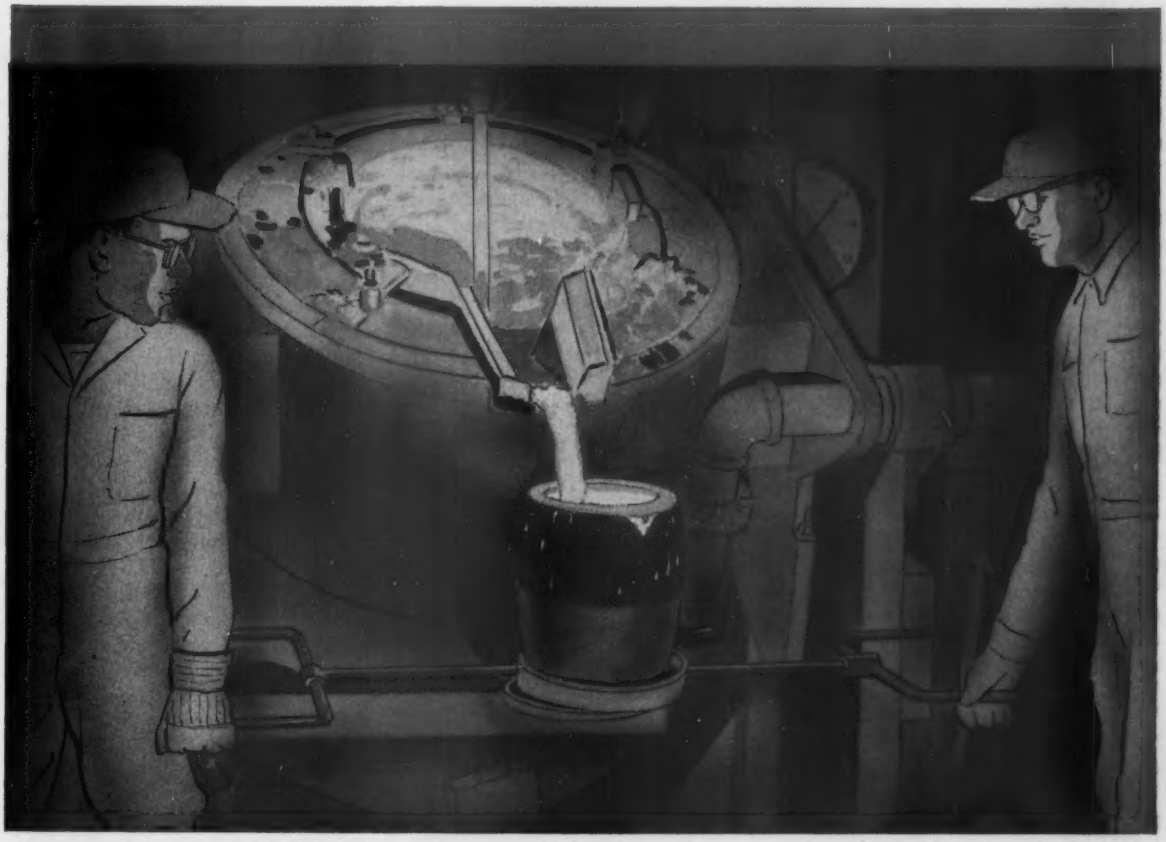

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as hardness, good tensile strength, impact strength, elongation, dimensional stability, ability to be heat treated, electrical conductivity, thermal conductivity, corrosion resistance, resistance to heat, cold flow resistance, and pressure tightness. The accuracy obtained in permanent molding usually is superior to that obtained in sand casting and not as good as in diecasting.

Impact Extrusions Today — by James M. Rich, Aluminum Co. of America. This presentation consisted almost entirely of a film which showed the types of parts that can be produced as impact extrusions.

Aluminum Sand Casting, a Competitor of Diecasting—by Thomas B. Pfaff, Pontiac Motor Div., General Motors Corp. Pontiac has converted a sand molding line in its gray iron foundry to the production of aluminum sand castings. This line features new electric induction melting facilities and automatic pouring (See p. 78 for full details). On this line, with one set of patterns, the division can produce 200 cylinder blocks an hour with no further investment in new facilities. Pontiac is confident that the role of the sand caster in producing aluminum castings to industry standards is on the rise.

Dictaphone Corp. Magnesium Diecasting Experience—by Frederick W. Roberts, Dictaphone Corp. Small parts for the company's dictating machines were made as zinc diecastings as long ago as 1918. Today, frames and enclosures and other parts for the machines are made from diecastings, largely magnesium.

The diecasting process gives good detail, permits casting in of attachment bosses, makes it possible to design stiffness into parts, and provides economical production. Magnesium is especially valuable as a diecasting metal in the production of dictating machines because of its high internal damping characteristic. Weight savings also are extremely important. Magnesium machines easily and is simple to straighten.

Plastics—Competitor of Diecastings—by William O. Bracken, Cellulose Products Dept., Hercules Powder Co. The history of plastics as engineering materials covers a span of about 20 years. Today, with the development of low-cost, lightweight, rigid, heat-resistant plastics, a new group of synthetic materials is being considered as replacements for diecast parts. In many applications, despite an apparent disparity in rigidity and raw material cost, it is not only practical, but also commercially attractive to design parts for some of the newer plastic materials in preference to previously used zinc and aluminum diecastings.

Quality Control

How Casting Defects Affect Quality of Electroplated Zinc Diecastings—by William H. Safranek, Electrochemical Engineering Div., Battelle Memorial Institute. Procedures for electroplating exterior automotive zinc diecastings were improved strikingly during 1958 and 1959. Durability of the electroplated coating was increased at least threefold, and an eightfold improvement was obtained in some instances.

Tests have indicated, however, that diecasting quality has not kept pace with improvement in the durability of electroplated coatings. Diecasters will have to improve the surface quality of their castings to take full advantage of such superior electroplating procedures as duplex nickel, crackfree chromium, and duplex chromium plates. Over-all cost savings in the production of plated zinc diecastings are within the reach of any plant prepared to enforce high quality standards.

Quality Control and the Diecasting Machine—by Earle W. Rearwin, Reed-Prentice Div., Package Machinery Co. Control of quality in the diecasting process requires the determination and segregation of those elements in the casting cycle which affect casting quality. Because the cycle involves time phases of tenths of seconds or even millisecond, instruments must be used to measure time and force of the phases.

The casting cycle is more readily understood when considered as one continuous hydraulic circuit from the pump through the casting to the overflows and vents. As long as it is molten, the metal is only an extension of this circuit. Consequently, these factors are important to the control of casting quality:

1. Hydraulic pump. 2. Hydraulic accumulator. 3. Pilot valves. 4. Electric control circuit. 5. Hydraulic operating valves. 6. Condition of hydraulic fluid. 7. Temperature of hydraulic fluid. 8. Type of hydraulic fluid. 9. Condition of hydraulic shot piston. 10. Condition of metal plunger and tip. 11. Character of casting runner. 12. Character of casting gate. 13. Area and conformation of cavity vents. 14. Metal viscosity.

The Effect of Diecasting Practice on Casting Quality—by Al Sugar, Cast-Master, HPM Div., Koehring Co. Economical large-volume production of quality diecastings demands a smoothly working casting machine, a properly designed and constructed die, and a suitable alloy. Only after all these requirements have been met simultaneously can consideration be given to other variables in the diecasting process.

The importance of melting practice frequently is overlooked. Selection of appropriate equipment for specific needs calls for consideration of metal quality as well as of metal tonnage requirements. Two-stage melting, with separate breakdown and holding units, is preferable to achieve constant metal temperature and composition. Metal must be transferred, however, with a minimum of metal turbulence.

Design has an obvious bearing on the quality of a diecasting, and an understanding of die construction and operation can be of great value to the casting designer. If he can visualize the part he is designing as it will be cast and then ejected from the die, he gains a reasonable assurance as to whether or not his casting can be diecast successfully.

Review of Methods To Obtain Improved Corrosion Resistance for Plated Zinc Diecastings—by D. Millage, E. Romanowski, and Dr. H. Brown, Udylite Research Corp. Two systems of plating zinc alloy diecastings are achieving greatly improved outdoor performance of such castings. These systems involve the use of double-layered nickel or chromium deposits. Corrodkote and CASS accelerated corrosion tests have hastened the development of these dual plating systems.

Dual chromium and dual nickel appear to be about equal in performance. Dual nickel may have an advantage with intricately shaped diecastings, especially in marine atmospheres and where salt is used to de-ice streets. Dual chromium

may be preferable for diecastings of simpler shapes, especially in industrial atmospheres.

The copper-chromium-nickel-chromium system, not yet in use in production, has shown up well in all tests, but particularly in industrial atmospheres.

Cost and Profit

Automation in Diecasting — by L.S. Garretson and Tom E. Nadeau, Ford Motor Co. Work-saving devices are being employed to perform many tasks which historically have been performed by machine operators. Most of the devices do not reduce the need for an operator, but they often aid in achieving uniformity of conditions or an element of safety.

Generally, a fully automated diecasting machine operates much faster than its manually operated counterpart. Greater care is required in the adjustment of temperatures and timing to assure optimum results, but the product is fewer rejections, maximum speed, and prolonged periods of operation.

Short-Run Production Practice in Diecasting—by D. H. Naffziger, Delco-Remy Div., General Motors Corp. Short-run production should be separated from high-volume production. Three general approaches can be used in regard to physical layout: 1. All production in one area (preferably with machines grouped in relation to high and low-volume runs). 2. High-volume production in one department and low-volume production in another. 3. High-volume production and short runs of heavy castings in one department and short runs of small castings in another.

Selection of the physical layout depends on several factors peculiar to any given diecasting shop. Type of castings produced, machines, space, personnel available, and the over-all size of operations must be considered.

Advances in Impregnation Materials and Techniques—by George J. Caudron, American Metaseal of Detroit. One thought of only as a salvage process, impregnation today is an integral manufacturing step which both designers and process men consider to add value to products because it makes possible engineering improvements in complex parts. Basically, impregnation is the process of infiltrating open pores of a material, using a suitable vehicle. In current practice, this vehicle often is a filled sodium silicate impregnant or a 100 per cent solids polyester resin.

Success of the process depends on two factors: 1. Infiltration of the pores. 2. Retention of material in the pores by capillary action. Two impregnation methods now are used and accepted—internal pressure, using a jig and fixture transfer-type machine, and vacuum and pressure, using immersion-type equipment. Ability of the impregnant to stay in the pore is created by the fact that surface tension—that is, capillary action—within the pore is greater than scrubbing action at the pore entrance. This scrubbing action is caused by later processing such as washing.

A Case Study in Establishing Diecasting Costs—by Urban F. von Rosen, Soloway & von Rosen. Case study described predetermination of

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MELTING DATA

500 LB.	1000 LB.	2000 LB.
Time: 30 min.	Time: 40 min.	Time: 45 min.
Oil Used: 11½ gals.	Oil Used: 19 gals.	Oil Used: 40 gals.
*Gas Used: 1400 cu. ft.	*Gas Used: 2800 cu. ft.	*Gas Used: 5250 cu. ft.

*1030 BTU

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of sufficient temperatures to pour light and difficult castings of excellent structure and machinability, with practically no rejects—that's the money-saving story behind the performance record of the revolutionary new U. S. "Sklenar" Reverberatory Melting Furnace. Innovations in combustion, design and construction, with patented features that contribute to faster melting, built-in economy of operation, and lower maintenance costs, are all yours in tomorrow's method of melting metals today!

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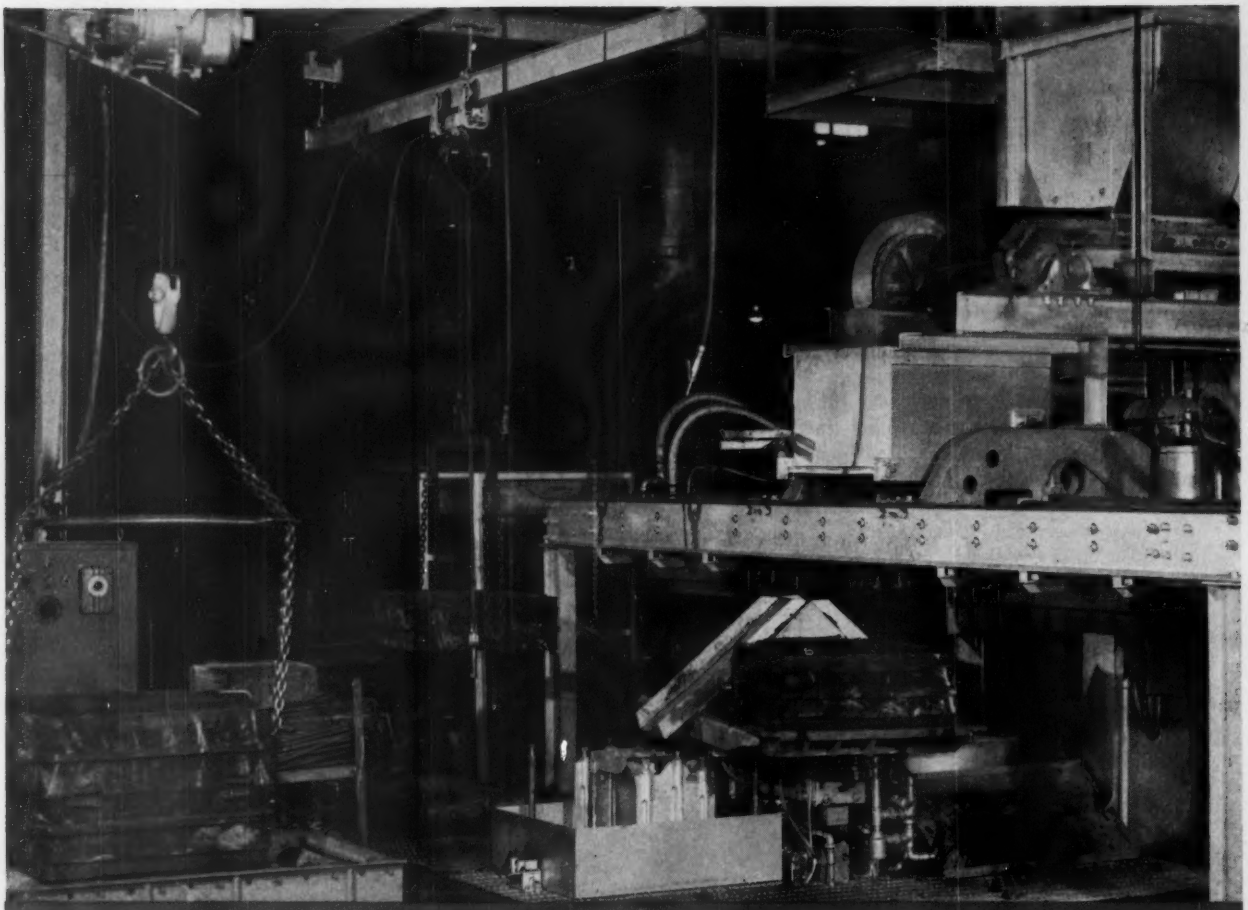
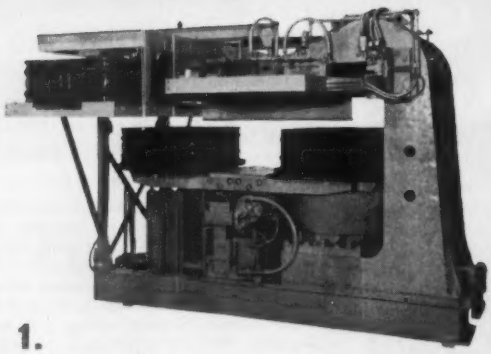
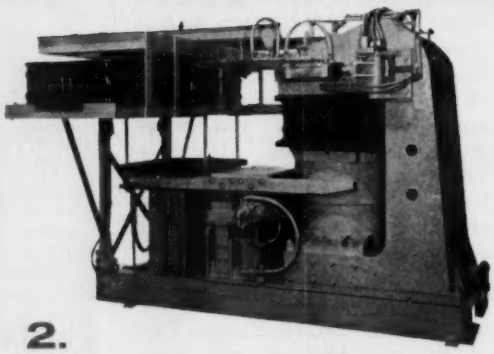




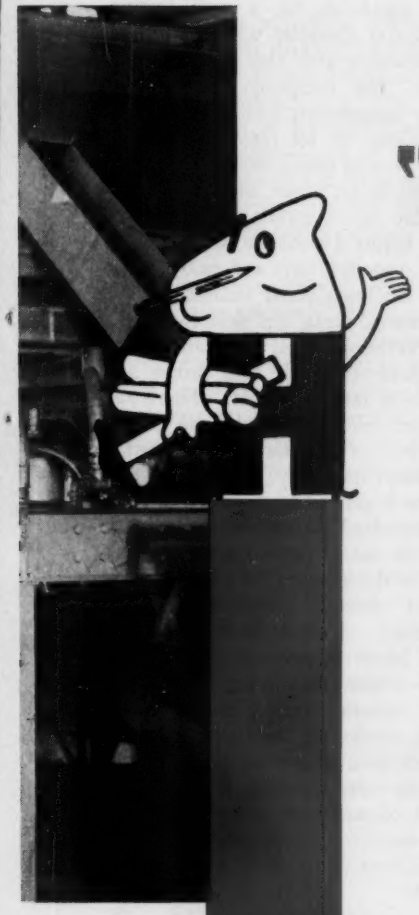
1.

Mold indexed to stripping station of machine and an empty flask to be produced positioned at the jolt squeeze station of machine.



2.

Mold has been stripped, at stripping station of machine, the flask filled, jolted, struck off and is being squeezed at jolt squeeze station.



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The story goes like this, very briefly.

Originally the customer-company was producing 100 complete molds per day.

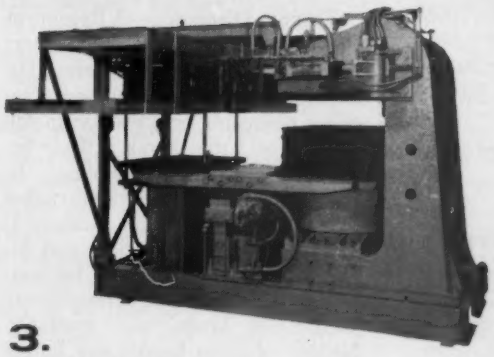
Jolt rollover and draw machines were replaced, in a new automated molding cycle, with the Herman Stationmaster, producing both cope and drag molds.

Production climbed to 300 complete molds per day, with a proportionate reduction in manpower!

Herman further stated in unveiling this case history, the Stationmaster was disassembled after one year's operation and parts wear was negligible.

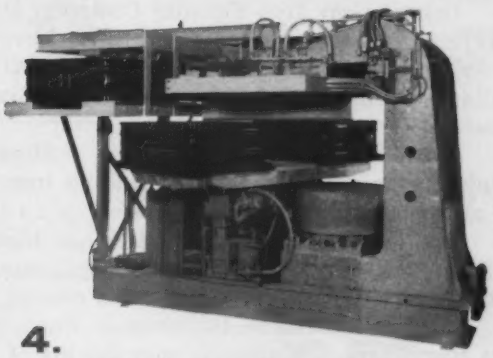
Why *not* investigate the cost-cutting advantages of a Herman machine in your plant?

A nearby Herman sales engineer will gladly give you full details.



3.

Mold has been discharged and empty flask placed above the stripping pins. The mold has been squeezed at jolt squeeze station.



4.

Empty flask has been lowered onto the pattern and is being indexed to jolt squeeze station. The mold is being indexed to stripping station.

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Detroit Gray Iron Foundry Company, Detroit, Michigan, uses NATIONAL Western Bentonite as the sand-bonding agent for a wide variety of castings. Detroit has found that the results are rewarding . . . smoother surfaces, closer tolerances, more faithful reproduction of patterns.

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cost standards for a well known Cleveland diecaster who has a line of products and also does jobbing work. The company has a time study department which sets standard times on all operations. Only base rates of direct workers are considered direct labor. Shift premium, holiday pay, overtime premium, factory bonus (based on wage incentive), vacation pay, and paid lunchtime are considered indirect labor.

Since all scrap and defective parts are remelted, metal cost can be determined accurately after proper adjustment for metal loss. There remained, therefore, only the establishment of standard departmental overhead rates.

The first consideration in developing standard departmental overhead rates is the proper departmentalization of the plant. With the departments defined, establishment of standard departmental overhead rates involved three steps: 1. Allocation of manufacturing expenses to the various factory departments, both producing and service. 2. Distribution of service departments to other departments. 3. Establishment of standard or normal rates per machine hour and per direct labor hour for all producing departments.

Vacuum Diecasting

Vacuum Diecasting—A Resume of Progess to Date—by Hiram K. Barton, Hiram Barton Associates. Today, it hardly is possible to name one major diecasting organization in the whole world that is not actively interested in vacuum diecasting. In the past, vacuum techniques failed to stick for two main reasons: 1. Vacuum pumps were slow and ineffective. 2. No equipment for controlling the timing of evacuation to millisecond limits was available. Neither of these factors any longer is a problem.

The recurrent urge to apply vacuum methods to diecasting always has arisen from the desire to eliminate porosity and so improve the mechanical properties of castings. It is true that good gating practice minimizes porosity, but even in the most advanced shops, a lot of gating design is done with a welding rod, not a pencil. The simplest solution is the scientific solution, however, and if vacuum diecasting did

Circle 646 on Page 39

no more than eliminate the need for the guy with the built-in rabbit foot, it would be worth the closest attention of the industry.

Some Effects of Vacuum Casting on Surface Finish—by E. L. Simpson, Bell & Howell Co. Production records and preliminary test results at Bell & Howell indicate three conclusions:

1. Where castability is poor because of the geometry of the part, vacuum is a decided advantage in obtaining good surface finish. It is not a cure-all, however; conventional casting techniques also are helpful and necessary.

2. In some specific applications, vacuum makes possible the use of hard-to-cast alloys with desirable properties when they would not be practical with conventional casting. Some undesirable characteristics, such as hot shortness and a tendency to solder, are not likely to be reduced significantly by vacuum.

3. Preliminary tests indicate that conversion of a die to the die evacuation method of vacuum casting, used at B & H, to improve on anodizing or chrome plating would yield doubtful results, although it might reduce blisters during chrome plating.

Use of Vacuum in Production of High Quality Aluminum and Zinc Diecastings—by J. A. Woltering, Hamilton Die Cast Inc. When first introduced commercially five or six years ago, vacuum was accepted as a cure-all by an industry eager for a crutch to lean on. Since then, many shops have tried various vacuum packages, some successfully, but most with indifferent results.

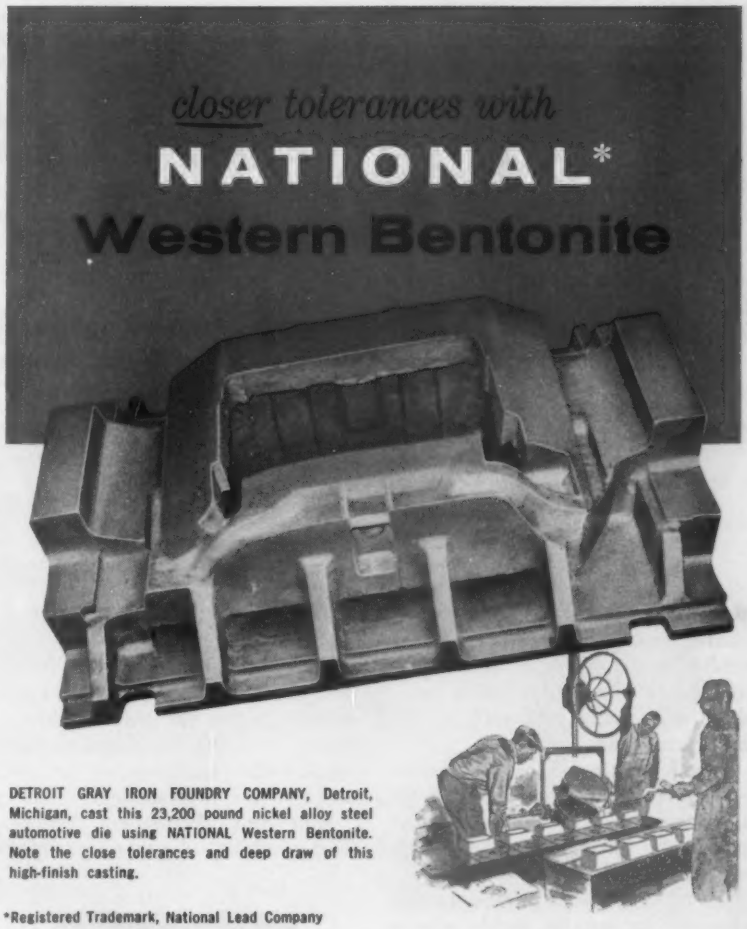
Like any new production tool, however, vacuum equipment must be refined and its limitations established. In each plant, the system must be adapted to a particular set of circumstances and requirements.

After using vacuum in zinc diecasting for more than two years, Hamilton Die Cast is completely satisfied that it offers tangible advantages unobtainable without vacuum. It reduces porosity and produces better casting finish. With a combination of vacuum and a newly developed alloy, the company has been able to produce aluminum diecastings which can be anodized, chrome plated, porcelain coated, dip brazed, or welded (see FOUNDRY, November, 1960, p. 114).

closer tolerances with

NATIONAL*

Western Bentonite



DETROIT GRAY IRON FOUNDRY COMPANY, Detroit, Michigan, cast this 23,200 pound nickel alloy steel automotive die using NATIONAL Western Bentonite. Note the close tolerances and deep draw of this high-finish casting.

*Registered Trademark, National Lead Company

These dealers stock NATIONAL Western Bentonite

American Steel and Supply Company, Chicago, Illinois
Asbury Graphite Mills, Inc. Asbury, New Jersey
Asher-Moore Company, Richmond, Virginia
Brandt Equipment and Supply Company, Houston, Texas
George W. Bryant Core Sands, Inc., McConnellsville, New York
The Buckeye Products Company, Cincinnati, Ohio
Canadian Foundry Supplies & Equipment Ltd., Montreal 30, Quebec (Main Office)
Canadian Foundry Supplies & Equipment Ltd., Toronto 14, Ontario
Combined Supply & Equipment Company, Buffalo, New York
Foundries Materials Company, Coldwater, Michigan
Foundries Materials Company, Detroit, Michigan
Foundry Service Company, Birmingham, Alabama
General Refractories Company, Indianapolis, Indiana
The Hoffman Foundry Supply Co., Cleveland, Ohio
Independent Foundry Supply Company, Los Angeles, California
Industrial & Foundry Supply Company, Oakland, California
Interstate Supply and Equipment Co., Milwaukee, Wisconsin
Klein-Farris Company, Inc., Boston, Massachusetts
La Grande Industrial Supply Co., Portland, Oregon
Marthens Company, Moline, Illinois
Midvale Mining and Manufacturing Co., St. Louis, Missouri
Carl F. Miller and Company, Inc., Seattle, Washington
John P. Meninger, Elmwood Park, Illinois
Pennsylvania Foundry Supply & Sand Co., Philadelphia, Pennsylvania
Robbins and Bohr, Chattanooga, Tennessee
Smith-Sharpe Company, Minneapolis, Minnesota
Steelman Sales Company Munster, Indiana
Warner R. Thompson Company, Detroit, Michigan
Western Materials Company, Chicago, Illinois

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6107 A

Concluding Reports on

International Foundry Congress

Here are concluding reports on technical papers presented at the recent International Foundry Congress, in Zurich, Switzerland. These papers deal with the production of nonferrous castings

By M. M. HALLETT
Managing Director
Chamberlin & Hill Ltd., Walsall, England
European Editor, Foundry

● SEVERAL papers devoted to nonferrous castings discussed studies of metal fluidity, use of aluminum for permanent molds, anodized aluminum, and lead in tin bronze castings.

Metal Fluidity—S. Morita (Japan —written in English) reported on the importance of the degree of supercooling in determining fluidity of molten metal.

Using three types of straight test channels in metallic molds, also a spiral shell mold, he studied aluminium-copper alloys, aluminium-silicon alloys, aluminium-manganese alloys and ternary aluminium alloys, pouring all alloys at a constant superheat above the liquidus.

Results indicated that the minimum fluidity was not found at the composition with the widest solidification range and that maximum fluidity occurred in hypereutectic alloys rather than exactly at the eutectic content, as commonly supposed.

It was also found that holding an alloy molten at a high temperature increased fluidity when poured subsequently at a lower constant temperature. Similarly in cast iron, either of normal type or a titanium content type with very fine flake graphite, it was found that hypereutectic iron had higher fluidity than iron with a carbon equivalent value at the eutectic content.

All of these results were attributed to the degree of supercooling. It was suggested that for a given depression of the eutectic temperature, the degree of undercooling below the liquidus temperature would increase on passing beyond the eutectic content, hence the time for longer flow in the test piece would increase. Holding in the molten state would reduce nucleation in the melt and increase supercooling.

Aluminium Permanent Molds—The possibility of using aluminium permanent molds for the production of aluminium alloy piston castings was investigated by K. Marechal (Hungary — written in German).

D. ISIDRO SANS BARNIS

President, International Committee of Foundry Technical Associations, 1961

Working on aluminium alloys with copper and nickel at higher and lower silicon levels both in the as-cast and heat-treated conditions, it was found that the castings made in aluminium permanent molds solidified much more rapidly than those made in iron molds. This resulted in a finer grain size and consequently better mechanical properties.

Furthermore, the fine grain castings made in aluminium molds exhibited much less scatter in mechanical property and hardness values, not only in repeat tests but also in different locations in one casting. A particularly notable improvement also was found in impact value.

It was stated that the cost of aluminium molds is less than that of iron, and attention was drawn to the virtues of anodized aluminium. Although the anodized film is heat insulating, it could not be regarded as replacing mold coatings, which still must be applied.

Anodized Aluminium — E. A. Bloch (Switzerland — written in German) described the production of aluminium alloy castings intended for anodizing.

After describing typical examples and illustrating how the ability to take a polished highly reflective surface depends on the magnesium content, the following defects having a bad effect on surface finish were considered: Microshrinkage, coarse grain size, surface flow lines of oxide inclusions, hard inclusions and deep etching pits.

Microshrinkage can be avoided by adopting running systems which introduce molten metal at the bottom of the mold with a uniform rise and directional solidification,

BOOST PRODUCTION UP TO 25%

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Circle 645 on Page 39

examples being shown. Coarse grain size is prevented by known grain refiners such as potassium boro-fluoride with due allowance for the relatively rapid decay of the refining effect. Again the importance of uniform introduction of metal by controlled up-hill pouring was emphasized.

Oxide-containing flow lines also are avoided by slow and uniform pouring from the bottom, accompanied by tilting the mold. Hard inclusions are reduced by standing of the molten metal—since the inclusions are of higher density—and by avoiding the use of furnaces in which the metal is both melted and baled out. Deep etch pits often are connected with entrapped flake particles and standing of the metal promotes their separation on the surface of the molten bath.

Lead in Tin Bronze—L. Ekbom (Sweden—written in English) dealt with the effect of lead in promoting soundness in tin bronze castings.

It is well known that the 85-5-5-5 alloy tends to give sound castings. Metallographic investigations and density determinations showed that the separation of the lead-rich phase occurred fairly late in the solidification sequence and was characterized by zero shrinkage.

There may even be some expansion so that the lead-rich phase serves the same function as graphite in the solidification of gray cast iron. If, however, the lead content is raised too high, the separation of the lead-rich phase occurs too early during solidification when the crystal grains are not fully in contact and mass feeding is still taking place, so that the lack of volume change in the lead-rich phase is lost.

Practical tests confirmed the prediction and showed that the maximum useful lead content was 6.5 per cent at a tin content of 5 per cent. Calculation was made of the optimum lead content at several different tin contents and showed that as tin increased, the best lead content decreased, but that as the shrinkage was higher with higher tin contents, the best alloy from the soundness point of view should have lower tin and higher lead contents than in the usual 85-5-5-5 composition.

Labor Relations — H. Schindler (Switzerland—written in German) presented a short paper on the remarkable labor relations in the Swiss engineering industries. This condition originated 23 years ago when, under the obvious threat of Nazi neighbors, the whole nation appreciated the possible dangers and the leaders of the employers' association and the trades unions worked out an agreement which has governed industrial relations ever since.

In the 23 years there have been only 12 strikes with a negligible amount of time lost. Settlements are based on mutual trust in discussions, the renunciation of violent measures, and consultation between the parties concerned. Individual matters are discussed as they arise until agreement is reached; such an agreement is not subsequently challenged.

This helpful improvement in conditions has permitted much more exact planning and has facilitated the betterment of working conditions.

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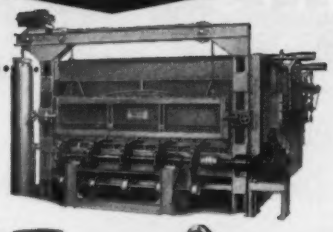

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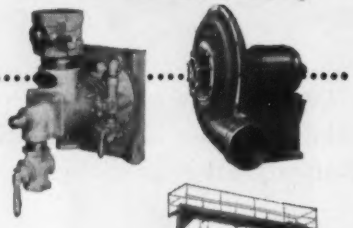

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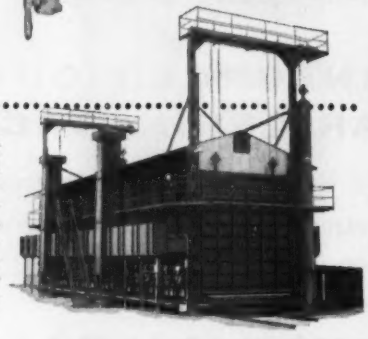
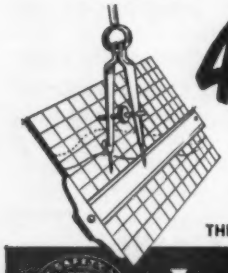
This 16′ x 80′ x 18′ car-type, stress relieving and normalizing furnace employs 52 JOHNSTON oil burners. Six program-type electronic instruments control temperature in a range from 1150 to 2150°F. It was engineered by JOHNSTON and built under JOHNSTON supervision with labor and materials furnished by purchaser.





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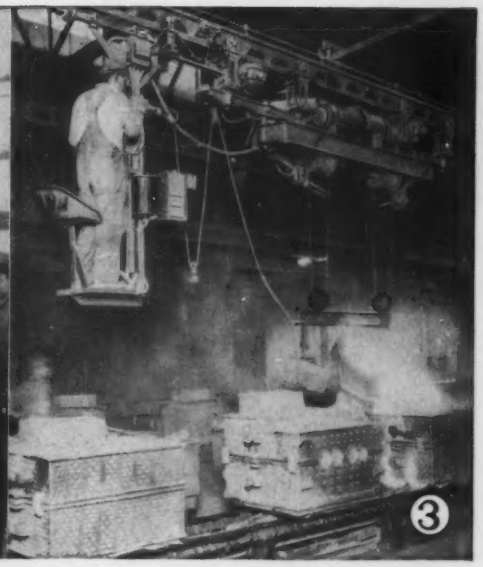

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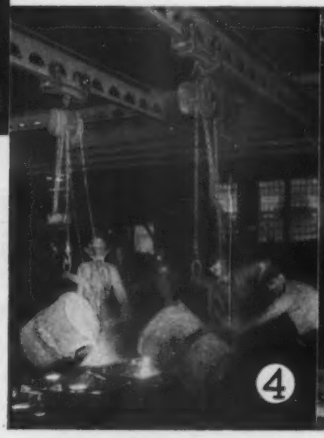

1 Small gray iron

2 Centrifugal pouring

3 Large scale continuous production

4 Large malleable

5 Brass and bronze

6 Large gray iron

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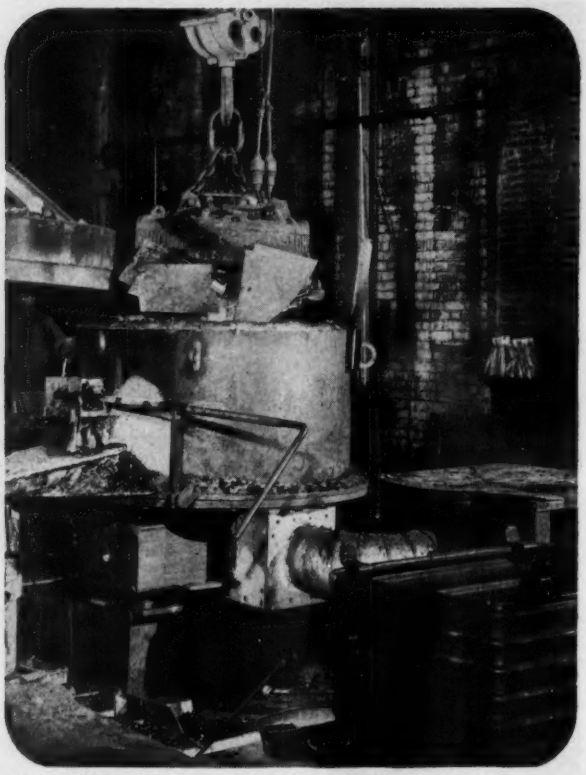
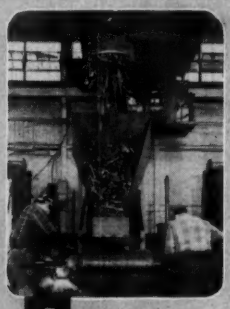


1 CHARGING FURNACE. One 36-inch Ohio Bolted Magnet charges six 375 KW furnaces giving 240 500-pound heats each 24 hours.

2 SCRAP HANDLING. All scrap is handled efficiently, economically with Ohio Magnet. Single 36-inch magnet replaces grapple, clamshell, bucket or lift truck.

3 SORTING. Castings are conveyed from Wheelabrator to hard-iron inspection. Ohio Magnet picks parts out of sorting bins.

4 UNLOADING ANNEALING FURNACE now takes one man 10 to 20 minutes with Ohio Magnet. Lift truck used to take 1 to 2 hours.



5 LOADING GRINDING HOPPER after conveying parts from inspection department. Same Ohio Magnet is used for operations shown in photos 3, 4 and 5.

Photos: Courtesy I-F Manufacturing Company, New Philadelphia, Ohio

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Small foundry or large, magnetic materials handling points the way to higher productivity, higher efficiency. And with Ohio Magnets on the job you get high availability, too. That's because Ohio Magnets are built with that extra margin of safety that means long, service-free life. Yes, *magnetic materials handling pays—especially with Ohio Magnets.*

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Circle 651 on Page 39

Men of Industry

W. O. DICK
. . . Canton Malleable v. p.

JACK MORGAN
. . . technical service mgr.

R. THOMPSON
. . . receives Award of Merit

FRANKLIN B. ROTE
. . . joins Mueller Brass

W. O. Dick has been appointed vice president and general manager of Canton Malleable Iron Co., Canton, Ohio, subsidiary of Penn Machine Co., Pittsburgh. Recently he was production manager of Baldwin - Lima - Hamilton Corp.'s industrial equipment division.

Jack Morgan has been appointed technical service manager, Foundry Services Inc., Berea, Ohio. He was chief metallurgist for Foundry Services (Canada) Ltd., and previously was with High Duty Alloys Ltd., Stough, England.

Norman Silverberg has been appointed sales manager of the West Coast division, Arwood Corp., New York, in charge of sales for the company's Los Angeles plant, where he will be located, and for its Mercast Div., at La Verne, Calif. He was chief standards engineer in Arwood's New York office. **Fred W. Dischinger** has been named midwest regional sales manager in charge of investment castings sales. He was general manager and chief engineer for Yoder Morris Inc., Cleveland.

John H. Simonds, president, Simonds Abrasive Co., Philadelphia, has been elected chairman of the board of directors of the Abrasive Grain Association, Cleveland, a trade organization whose members are manufacturers of aluminum oxide and silicon carbide abrasive grain.

R. Thompson, chief metallurgist, Dominion Engineering Works Ltd., Montreal, Que., recently received the Silver Medal Award of Merit of the Steel Castings Institute of Canada, for outstanding service to the Canadian steel foundry industry.

Franklin B. Rote has been named director of research and development, Mueller Brass Co., Port Huron, Mich. He resigned recently as vice president and technical director, Albion Malleable Iron Co., Albion, Mich., which he joined in 1951.

A. J. Fruchtl, of the research and development staff of James B. Clow & Sons Inc., Coshocton, Ohio, has been named technical director of

FRED W. DISCHINGER

NORMAN SILVERBERG
. . . Arwood Corp. appointments

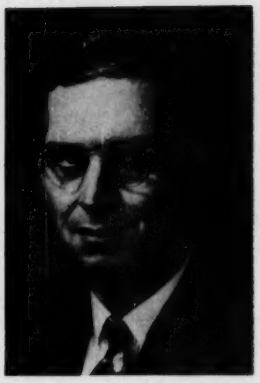
A. J. FRUCHTL
. . . becomes technical director

JOHN H. SIMONDS
. . . heads Abrasive Grain group

CARL F. JOSEPH
. . . retires after 43 years

EDWARD FIESINGER

ANTHONY IZZO



JOHN FEOLA

. . . promotions at Crouse-Hinds Co.

the Metters-Clow Pty. Ltd., Melbourne, Australia, a cast iron pressure pipe plant owned jointly by General Industries Ltd., Sydney, Australia, and James B. Clow & Sons Inc., Chicago.

Carl F. Joseph, since 1946 technical director of Central Foundry Div., General Motors Corp., Saginaw, Mich., has retired after 43 years of service. Previously he was chief metallurgist of the company's former Saginaw Malleable Iron Div. In 1943 Mr. Joseph was awarded the William H. McFadden Gold Medal of the American Foundrymen's Society, and in 1959 the Charles H. McCrea Medal of the Malleable Founders' Society, for his outstanding contributions and service.

Clair Miller, assistant purchasing agent, has been appointed director of purchases, Auto Specialties Mfg. Co., St. Joseph, Mich.

Edward Fiesinger has been appointed labor relations manager, Crouse-Hinds Co., Syracuse, N. Y. **John Feola** has succeeded Mr. Fiesinger as general foreman of the iron foundry. **Anthony Izzo** takes over Mr. Feola's former duties as general foreman of the nonferrous foundry.

Arnold A. Abineri has been made president of Cleveland Electro Metals Company, Cleveland.

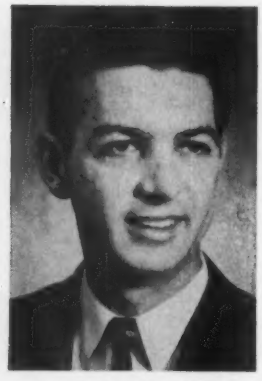
T. R. Elmblad has been named manager of the New York domestic sales office, Whiting Corp., Harvey, Ill. **A. C. Kukral,** recently in the Cleveland office, succeeds Mr. Elmblad there as manager. **R. J. Enroth** moves from the Chicago to the New York domestic office. **F. R. Schwantes** has been transferred from Chicago to Cleveland.

Thaddeus Giszczak, since 1951 chief metallurgist of the Defiance, Ohio, plant, Central Foundry Div., General Motors Corp., has been made divisional chief metallurgist, with headquarters in Saginaw, Mich. He joined Central Foundry Div. as a metallurgist in 1950.

John Walker has been appointed general manager, and **Robert Button,** assistant general manager, Homer Foundry Corp., Coldwater, Mich. Mr. Walker was plant manager, Detroit Gray Iron & Steel Foundries Inc., Detroit, and Mr. Button, plant manager, Ideal Furnace Co., Milan, Mich.

Raymond O. Oyler has been elected vice president, Bunting Brass & Bronze Co., Toledo, Ohio, in addition to his duties as director of sales.

Thomas H. Spencer has been appointed vice president in charge of engineering, MetaMold Aluminum Co., Cedarburg, Wis., subsidiary of Dayton Malleable Iron Co., Day-



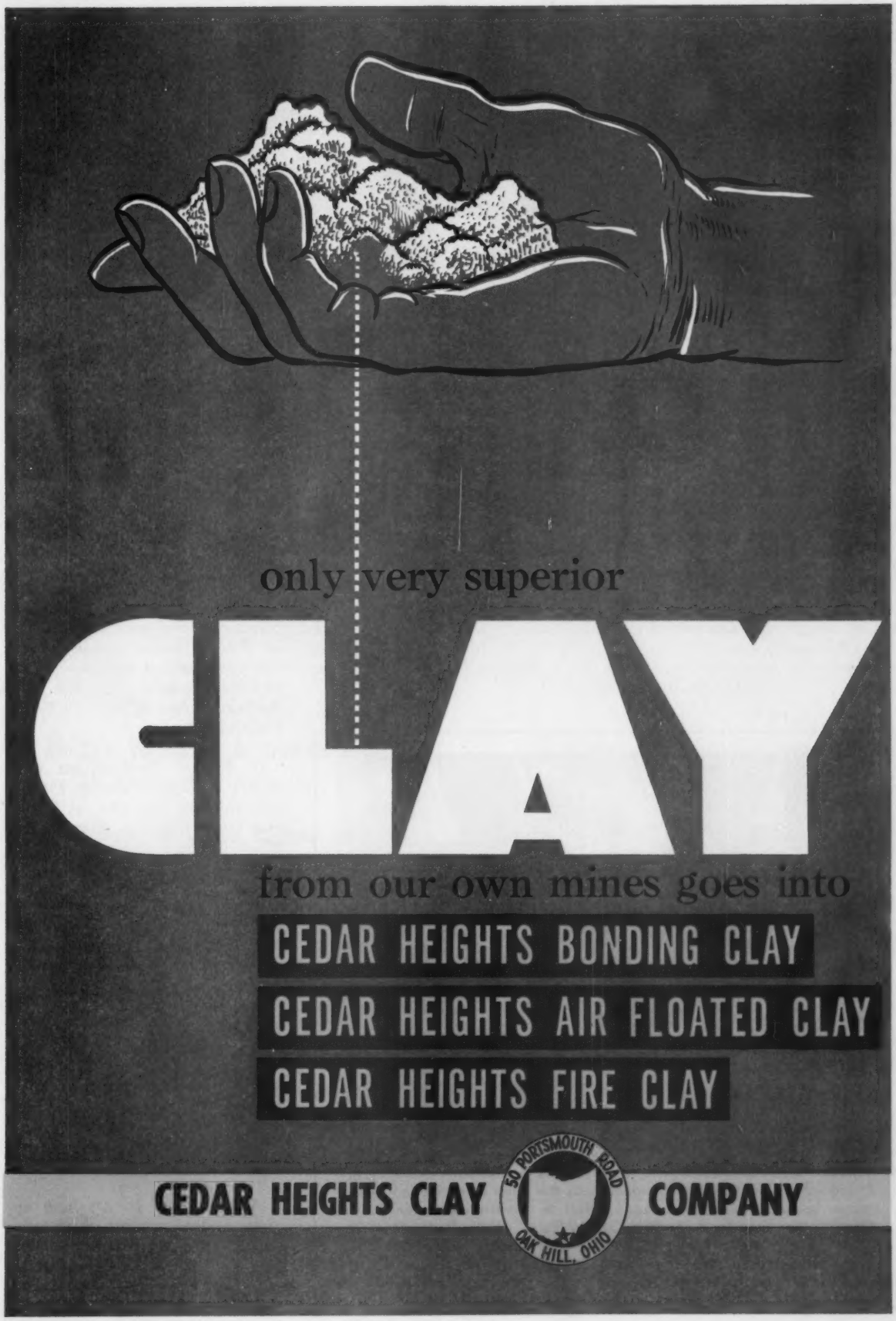
R. J. ENROTH

A. C. KUKRAL

T. R. ELMBLAD

F. R. SCHWANTES

. . . appointments announced by Whiting Corp.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50 PORTSMOUTH ROAD
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COMPANY

WARD DOUGHERTY
. . . retires, Osborn Mfg. Co.

NORMAN F. TISDALE JR.
. . . Pittsburgh Metals v. p.

ORVILLE C. CHRISTENSEN
. . . alloy castings sales

PAUL H. SETZLER
. . . Lord Chemical v. p.

ton, Ohio. **Anthony Haswell** was re-elected chairman of MetaMold and **Richard B. Courchene** president.

Ward Dougherty, export manager of the machine division, Osborn Mfg. Co., Cleveland, has retired after 45 years of service. He joined the company as a field service engineer, became machine division sales representative, and as export manger traveled extensively in Europe and South America. He will reside in Attica, Ind.

Norman F. Tisdale Jr. has joined Pittsburgh Metals Purifying Co., Mars, Pa., as executive vice president. He was president of Can-Am Metallurgical Sales Co., Pittsburgh, which he formed in 1957. **Woodrow D. East** has been placed in charge of operations at Pittsburgh Metals. He was plant manager of the Englander Co., in Houston.

Orville C. Christensen has joined Minneapolis Electric Steel Castings Co., Minneapolis, responsible for sales of heat and corrosion resistant alloy castings. He was previously with Minnesota Mining & Mfg. Co., St. Paul, and Power Process Equipment Co., Minneapolis.

H. R. Stitely has resigned as president of Lord Chemical Corp., York, Pa., continuing as a director and consultant. **James F. Connaughton,** president of Bell Intercontinental Corp., South Bend, Ind., the parent company, succeeds Mr. Stitely. **Paul H. Setzler** has been named vice president and general manager of Lord Chemical. He was with Baldwin - Lima - Hamilton Corp., Philadelphia.

C. Richard Guilford has been named manager of Detroit Plastercast Foundry Co., Div. of Racine Foundry & Mfg. Co., Detroit. He joined Racine Foundry & Mfg. two years ago.

T. A. Cosh, chief metallurgist of the Alston Foundry Co., Cumberland, England, has been named a director of the company. Active in the British Steel Castings Research Association, he formerly headed its steelmaking section.

Joseph Bertuglia has been appointed production manager, International Casting Corp., New Baltimore, Mich. **Thomas Reid** has been made superintendent of the foundry division.

A. S. Blodget Jr. has been appointed vice president of the midwestern region, Air Reduction Sales Co., New York, succeeding **D. D. Spoor,** who has retired. Mr. Blodget joined the company in 1938, and

WILLIAM B. COLEMAN NIGHT: Mrs. William B. Coleman, widow of AFS Philadelphia Chapter's first chairman, was the guest at a meeting of that group honoring her late husband. Left to right are Warren Brown, Florence Pipe Foundry & Machine Co.; William C. Hale, Dodge Steel Co.; Mrs. Coleman; and Robert C. Stokes, Crown Nonferrous Foundry Co., chapter chairman. Each year, the chapter awards a scholarship in honor of Mr. Coleman to a deserving senior at Pennsylvania State University

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Works Equally Well with Any Binder

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- **The fastest! A batch every 75 seconds.***
- **Absolutely no lumps or wet spots!**
- **Easiest to clean! Just reach inside.**
- **Only one moving part. No maintenance worries.**
- **3 times lower initial investment than with most mullers!**

*Applies to CO_2 sand. Oil sand may take up to three minutes.

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CARVER Automatic Gassing Apparatus

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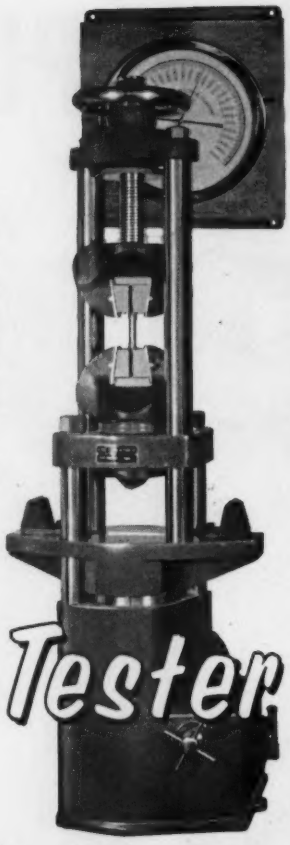
■ COMPRESSION

Answer your needs for tensile, transverse, and compression testing with our Universal Testing Machine. Specify the maximum load you require, anywhere from 100 to 40,000 lbs. Only two simple controls operate these hydraulically powered, automatic machines. Test results are instantly read from the load gauge.

Ask for catalog sheets and prices, or send us your requirements for a quotation as this testing machine can be modified in many ways.

Investigate the 'DETROIT' line of hardness testers, ductility testers, and tensile testers. Special testing machine requirements are welcomed.



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Circle 654 on Page 39

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5	Lbs. Silicon	.95
265	Lbs. Ferro-Chrome 70%	64.00
90	Lbs. Nickel	66.60
1.5	Lbs. Calcium/Silicon	.39
635	Lbs. Ingot Iron	47.78
		$181.47

TYPE 304 STAINLESS PRE-ALLOYED FURNACE CHARGES

1000 LBS. $.14 LB.* $140.00

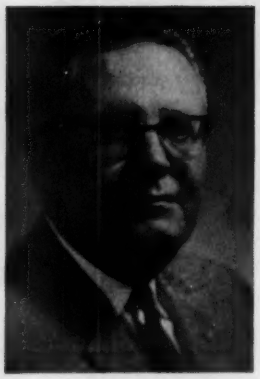
*Average price for type 304 paid first half year 1960

This comparison reveals a charge savings in excess of $40.00. Think of the additional savings in reducing the necessity of multiple purchase orders, freights, handling and storage. Time consuming **Charge Make Up** is eliminated also because Alloying has already been done for you.

For more information on type 304 Stainless Steel or other Nickel Alloys Contact
FOUNDRY DIVISION

SECURITY ALLOYS CO. INC
3100 West 49th Place, Chicago 32, Illinois

SEND FOR FREE POCKET-SIZE ALLOY SLIDE CHART
Complete analysis of over 100 nickel-cobalt alloys



PHIL SHERIDAN
. . . Cleveland Flux sales

for the last three years has been sales manager of the eastern region.

Phil Sheridan, formerly foundry superintendent, Frazer & Jones Co. Div. of Eastern Malleable Iron Co., Solvay, N. Y., has been appointed sales representative for Cleveland Flux Co., Cleveland, to cover Pennsylvania, Ohio, and New York.

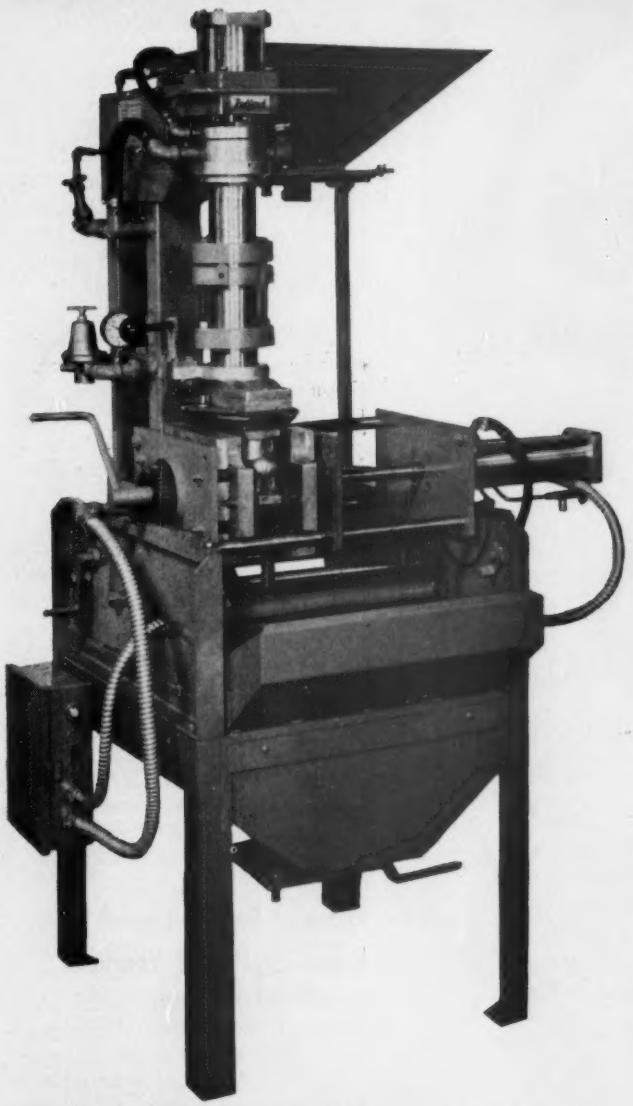
Richard N. Ames has joined Kaiser Refractories & Chemicals Div., Kaiser Aluminum & Chemical Corp., Oakland, Calif., as technical services specialist in refractory problems, with headquarters in the Chicago area.

Linwood A. Stedman has been named manager of the New England district, Pangborn Corp., Hagerstown, Md., with headquarters in Springfield, Mass. He succeeds **John H. Connolly,** who has retired after more than 22 years as district manager.

LINWOOD A. STEDMAN
. . . Pangborn district mgr.

Redford

MODEL HP-4
SHELL CORE BLOWER



A very fast low cost machine that is setting new standards in the production of small shell cores. The quality of intricate shell cores is improved because sand is blown into core box cavities through unrestricted blow holes. A novel cradle-type core box clamp is used to invert the core box and at the same time bring the core box within easy reach of the operator for core removal. There is no out of balance weight to struggle with. The machine can handle core boxes up to 10″ x 10″ in size. Shell cores may weigh up to 4 lbs., before draining.

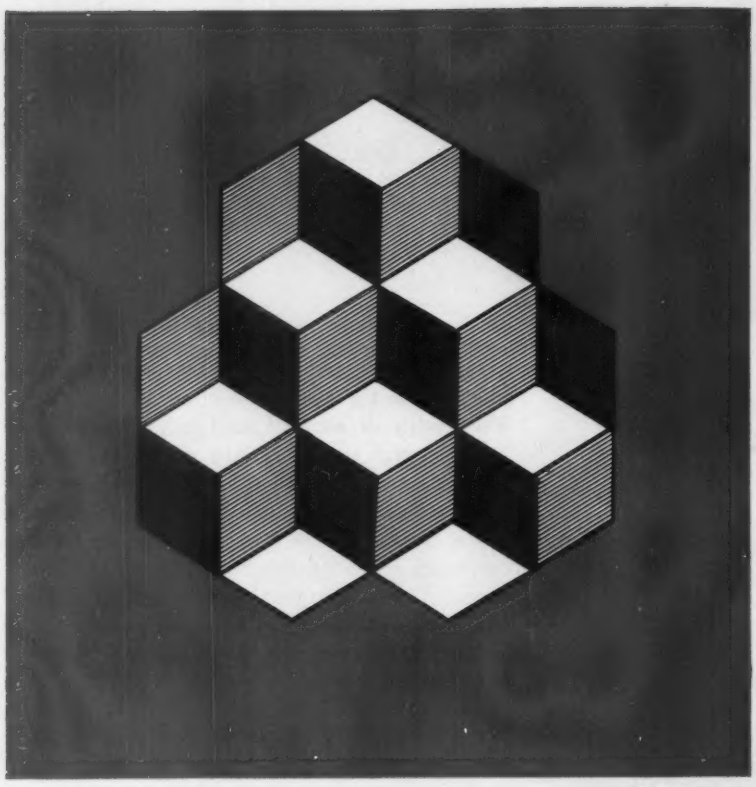
The HP-4 Redford has ample blow capacity and can also be used to blow Furfural resin sand mixes into heated core boxes.

Price F.O.B. Detroit—$1,200.00
For complete information write for Bulletin HP-4

. . Above cores illustrate the variety of work that can be done with the Redford HP-4 Core Blower.

REDFORD IRON & EQUIPMENT CO.
20733 Glendale - Detroit 23, Mich.
Phone: KEnwood 1-8611

Circle 656 on Page 39



TAKE A SECOND LOOK! Are you getting FULL Value for your Abrasive Dollar?

Count the cubes in the figure. You'll see six or seven, depending upon your point of view. Consider the total value of your present abrasive, and compare it with the proven value of Wheelabrator Steel Shot. Not just in price, but in abrasive consumption, cleaning speed, cleaning quality, and equipment maintenance costs as well. From any point of view, the proven quality of Wheelabrator Steel Shot adds up to extra value and extra profit.

Write today for this new handbook of blast cleaning abrasive performance. It's full of charts and facts you can use to help cut abrasive consumption, reduce cleaning costs. Write to Wheelabrator Corp., 505 S. Byrkit St., Mishawaka, Ind. In Canada, P. O. Box 409, Scarborough, Ont.

WHEELABRATOR
STEEL ABRASIVES

Obituary

W. C. Schartow, 50, plant manager, Chevrolet-Gray Iron Foundry Div. of General Motors Corp., Saginaw, Mich., died recently. He was graduated from General Motors Institute in 1932, became production superintendent of the foundry in 1951, general superintendent of production in 1952, and plant manager in 1956.

L. E. Emery, 38, chief metallurgist, Marion Malleable Iron Works, Marion, Ind., died Oct. 16. Prior to joining the company in 1951 he was chief metallurgist, Lake City Malleable Iron Co., Ashtabula, Ohio, and plant metallurgist, Benton Harbor Malleable Industries Inc., Benton Harbor, Mich.

Jack T. Massengale, 54, co-founder and general manager of Sherman Foundry Co., Sherman, Tex., died Dec. 4. At the age of 16 he joined Washington Iron Works, and in 1946 helped to organize the Sherman Foundry.

Carl J. Kohler, 55, secretary of Kohler Co., Kohler, Wis., died Nov. 11. He joined the company in 1928 as a research engineer, and became secretary in 1948.

Howard C. Cross, treasurer of the Cincinnati Steel Castings Co., Cincinnati, died Dec. 4.

Walter L. Reynes, personnel manager of K O Steel Castings Inc., San Antonio, Tex., died Nov. 11.

National Safety Council Issues Statistical Yearbook

The 1960 edition of National Safety Council's statistical yearbook, "Accident Facts," now is available. It lists accident rates by major industry groups and includes facts on accident trends and off-the-job accidents.

The 96-page publication also provides ideas and facts for making speeches, writing articles, and planning safety campaigns. It may be obtained from the National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

The most expensive rejections: the ones you don't catch!

Once a part "sneaks through" into expensive and time-consuming forming operations, costs skyrocket. That's why Ansco designs films of maximum readability . . . to catch defects in the initial X-ray inspection.

If you are at all concerned about the ones that "sneak through," check Ansco!

Here are four fine Ansco X-ray emulsions to suit your every need: Ansco Superay 'A', fast, high definition film for general purposes. Superay 'B', ultra-fine grain, medium-speed emulsion for maximum detectability. Superay 'C', medium-fine grain and high-speed performance. Superay 'D', designed to provide extremely high speed when used with calcium tungstate screens. Ansco, Binghamton, N. Y., A Division of General Aniline & Film Corporation.

Ansco

Industrial X-ray

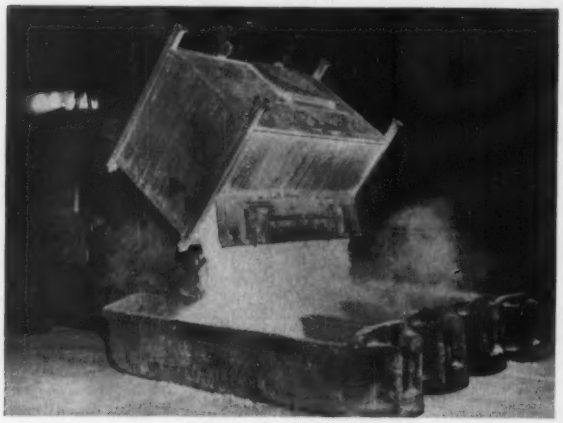
Circle 658 on Page 39

The Shakeout

Waterproof Boxes Are Used To Handle Lime

NINE ELECTRIC furnaces at Steel and Tube Div., Timken Roller Bearing Co., Canton, Ohio, require about 100,000 lb of lime daily when they are operating at full capacity. The lime formerly was bought in carload lots and either was dumped directly into charging boxes or piled into shallow containers on the charging floor with an emergency supply stored in a large bin. Besides being cumbersome and space consuming, this method permitted the lime to absorb moisture.

Waterproof metal containers 38 x 40 x 80 in. were designed to solve this problem. Ten of these con-



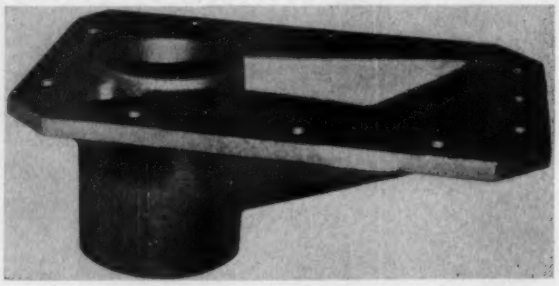
tainers fit on a truck flat bed, and each holds enough lime to fill three charging boxes. Ten containers are filled while in place on the truck bed, then are hauled to the loading area.

There, a fork lift unloads the containers from the truck and carries them to storage or to the charging floor for filling the charging boxes. Trapdoors release the lime when the containers are positioned over the charging boxes by the fork lift, and special legs allow the container to be stocked in storage. As a result, storage and handling of the lime is facilitated, and it no longer absorbs moisture.

Malleable Iron Casting Replaces Welded Steel

WHEN the manufacturer of a heavy duty earth scraper needed greater quantities of front axle pivot plates, a malleable iron casting was chosen to replace the steel weldment used previously. Two pieces of steel had been welded together, after the cylindrical section was bored, to form the part. After fabrication, costs were high because a flat bearing surface had to be prepared.

With the malleable iron casting, weight was reduced 21 per cent, cost was 43 per cent lower, and the appearance was said to be improved. Adequate strength and good bearing surface are other important

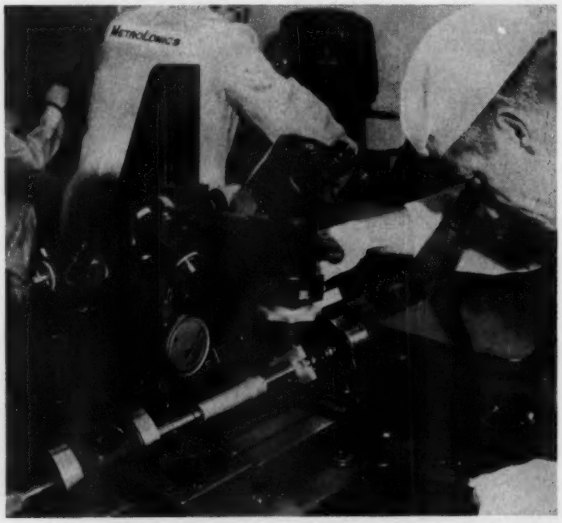


qualities of the cast part, which connects the axle and main body of the scraper. The casting, which is shown here, is made by Texas Foundries, Lufkin, Texas.

Company To Standardize Precision Instruments

THE FIRST standardizing laboratory in this country opened recently in Burbank, Calif. Known as Metrolonics Inc., the company will provide traceable standards calibration of precision measuring instruments. The company was organized to do business with missile contractors and subcontractors who are required to have their precision measuring instruments calibrated periodically.

A master lead screw mounted between centers is shown being checked to determine lead discrepancies



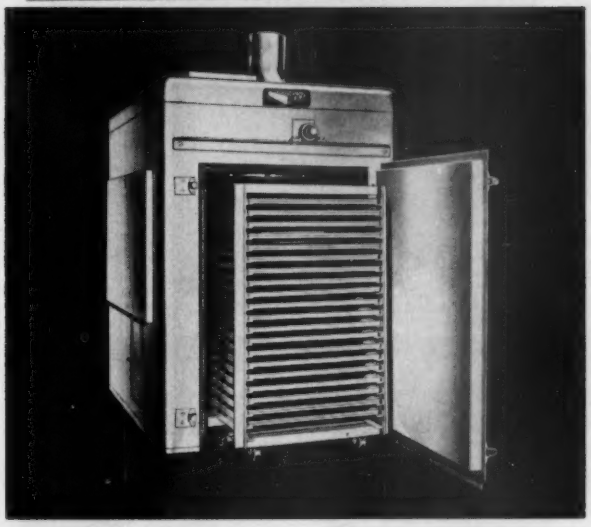
on a Zeiss Universal Measuring Machine. The German-made machine is used to check thread max OD, lead, half angles, forms, pitch, concentricity, and helix. It measures in two axes of measurement to 50 millionths of an inch and around two planes of rotation to 1 min of arc without removing the part from the instrument.

For More Details Circle No. 520—Page 39

NEW TRENDS

CALL FOR

NEW METHODS



MOCO Ovens Keep Pace With Forward-Looking Foundries

Increased output at lower cost per unit is the result when you specify industrial ovens *custom-engineered* for your application. That's why Michigan Oven Company heat treating equipment is best for aluminum alloy processing. MOCO-engineered ovens are backed by years of technical research to insure maximum heat processing efficiency.

Michigan Oven Company is well-known for its engineering and craftsmanship in building ovens to fit the specific needs of manufacturers in the foundry industry.

Naturally, you won't want to miss any *sound* ideas on a better way to process your product. MOCO engineering has many of them. Wouldn't it be wise to investigate?

WRITE TODAY FOR FREE INFORMATION

This MOCO technical literature points the way to many cost saving ideas. Send for it today without obligation.

MICHIGAN OVEN COMPANY

MOCO

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Circle 659 on Page 39

plastic mold and core duplications save time and labor

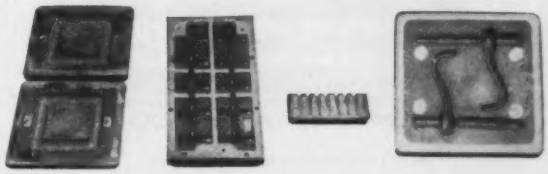
ren ®

Performance-proven in numerous foundry pattern applications, REN epoxy resins provide an economical answer to rising labor-material costs. The extreme workability of these dimensionally stable materials completely eliminates many costly standard duplication methods.

REN epoxy resin patterns are highly resistant to impact, chemicals and abrasion. They facilitate quick and easy release from sand—without the aid of lubricants. Exacting duplications—surfaces are smooth and free of voids and pits. Applications prove the production life of REN materials practically equals that of iron and aluminum.

At no obligation, send today for your subscription to REN'S bi-monthly publication, Tech-Ni-Tips/Digest.

4 PLASTIC PATTERN APPLICATIONS



A few of more than twenty patterns, duplicated from plaster casts by Wolverine Brass Works, Grand Rapids, Michigan, using REN plastic compounds. Comparison analysis proved Wolverine saved up to 66% in construction time—and up to 80% in labor using REN epoxy resins for these patterns.

OFFICES AND WAREHOUSES IN PRINCIPAL CITIES.

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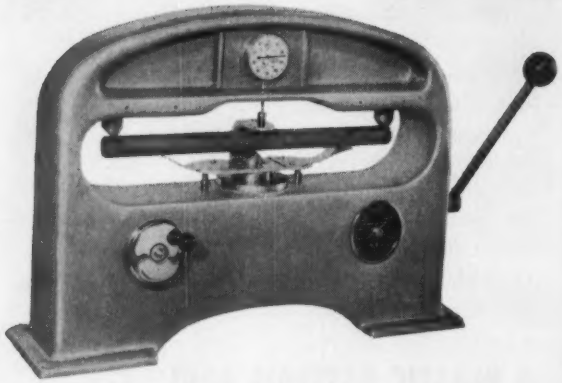
FOUNDRYMEN!!

NOW...A 4 MINUTE GRAY IRON TEST



- Obtain accurate technical data on brittleness and strength as soon as test bar has cooled.
- Test data complies with Federal Specifications QQ-1-652.
- No experience necessary... no need to shield from factory dust.
- Tester is bench type, requires little space. Low in cost and trouble-free.

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Careful balancing makes Penn Buckets self dumping when loaded and self righting when empty. Welded construction prevents "clinging" makes them empty easily and completely.

WRITE TODAY FOR NEW BULLETIN AND DIMENSION SHEET

No. 4-A
Self-Dumping

PENN IRON WORKS, INC.
READING, PENNA.

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MURPHY PISTOL SPRAYER guaranteed

2922

Forces blackening into pores and pockets of molds. Sprays silica wash, oil, or water equally well. Used also to sand blast, to clean automobile and diesel engines, to spray centrifugal molds. Standard of the foundry field for more than 50 years. Priced from $17.25. Write for quantity discounts.

(Also furnished in a deluxe model with air pressure reducing valve, 20' of air hose, and 5' of suction hose, both of superior quality, oil and acid resisting plastic.)

Ask your foundry supply dealer or —

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JAS. A. MURPHY & CO., INC.
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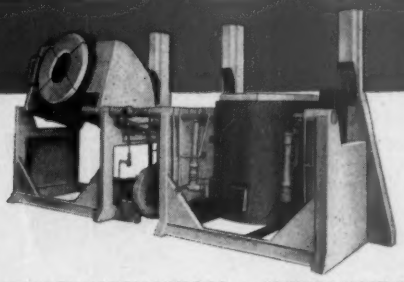
LOOK more New "tuff built" WARWICK FURNACES



All WARWICK Furnaces are designed and built to "take it"... deliver melt after melt with speed, efficiency and economy. They are the furnaces that you should investigate first before buying.

WARWICK MECHANICAL or HYDRAULIC TILT CRUCIBLE MELTING FURNACES

For brass, bronze, aluminum and other non-ferrous metals. Nose Pour feature assures a constant pouring arc, eliminating the necessity of moving the ladle at any time during a pour. They are excellent for use in permanent mold and die casting plants as well as any foundry. Their sturdy construction assures longest life, and their economical operation results in lowest production costs. Oil or Gas Fire. Built in sizes to handle capacities from No. 30 to No. 2000 Crucible.

WARWICK MANUAL TILT CRUCIBLE MELTING FURNACES

For Brass, Bronze, Aluminum

Designed for utmost production and longest crucible life. Assures perfect melts every time. Is so easy to operate and extremely economical. Oil or Gas Fire. Capacities from No. 30 to No. 1000 Crucible.

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SINCE 1895

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Remember ... WARWICK makes all types of furnaces for the finest and fastest melting of aluminum, magnesium, brass, bronze, and all other non-ferrous metals. Get the facts on how they can save you money. Write today for full information.

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For CORE WORK, SAND FACINGS, SPRAYS

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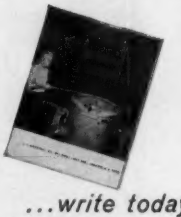
Marshall Thermocouples Promote Castings Quality!

Marshall Enclosed-Tip Thermocouples assure strong, dense, uniform castings from every nonferrous melt! Tip can be immersed 3 inches to 30 inches or more in depth and stirred to speed pyrometer reading. You get accurate temperature from deep within melt in about 20 seconds! Hot junction tip, armored with enclosing tube of special alloy, withstands scores of immersions before low-cost replacement is necessary. Thermocouple wire can't be contaminated from melt or shortcircuited by slag! Rugged, well-balanced Marshall Thermocouples are convenient to carry and use, simple and economical to operate. Available as Furnace Type (below) in lengths up to 10 feet, for use with Stationary Pyrometer . . . or Ladle Type for use with Portable Pyrometer.



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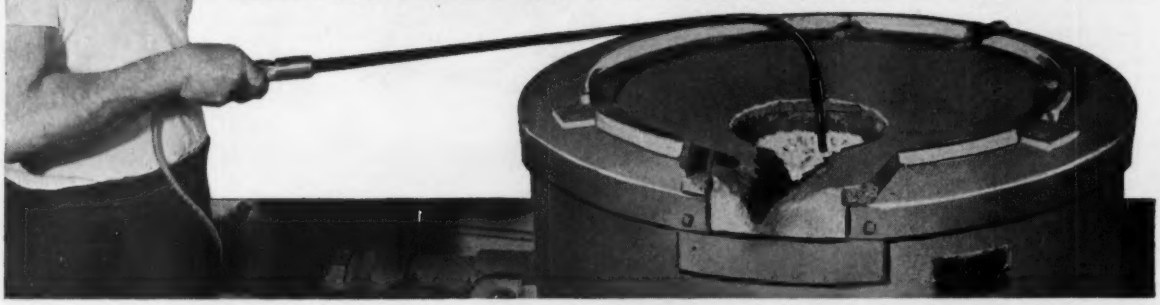

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Consulting Engineers

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METHODS—PROCEDURES
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COST SYSTEMS

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Use an Inquiry Card

For further information on anything described or advertised in this issue . . . . . .

SEE Page 39

HARTLEY *Controls* CORPORATION • NEENAH • WISCONSIN

Originators of Fully Automated Sand Systems for Foundries

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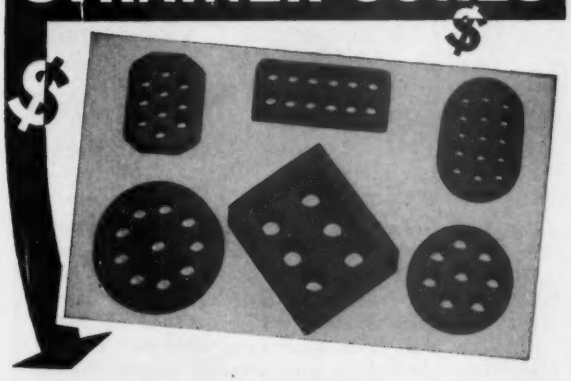

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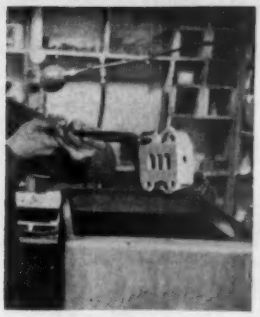
CORE BOX PROTECTION



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T.M. Reg.

Core Box & Vent Cleaner

SAFE, HARMLESS TO HANDS

TYPE 1: Water-mixed. Use for oil bonded sands.

TYPE 2: Removes baked resins and silicones build-up on shell equipment.

KEEP VENTS CLEAN WITH CORCOSOLV

FREE SAMPLES ON REQUEST

"QUICKINSERT" core box vents • "PROTEXABOX" pins • "SAND ARRESTER" tubes • "HOLINER" bushings • PARTING LINE Sealing Strips

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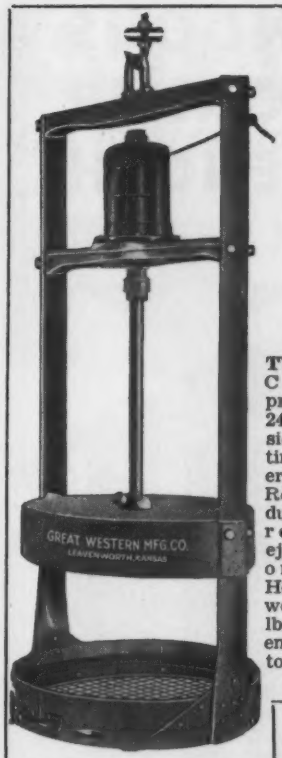
Circle 670 on Page 39



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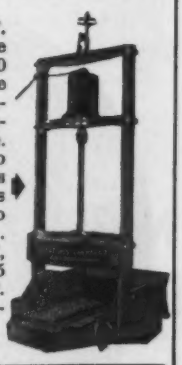
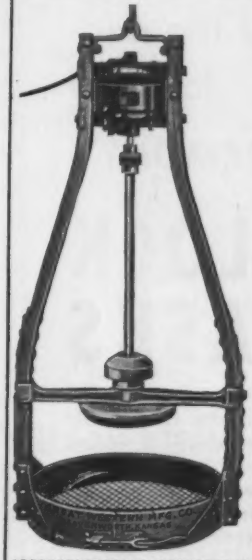
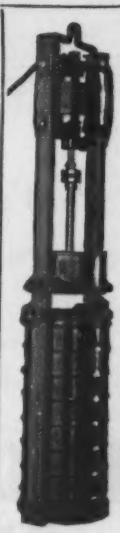
"Greatest Name in Motion"

TYPE "CS". Complete price $435.00 24" square sieve. A continuous operation sieve. Requires no dumping, as refuse is ejected off to one side. Height 4'10", weight 295 lbs, ½ H.P. enclosed motor.



TYPE "CR". Complete price $425.00. 24" dia. round sieve. Sifts, fluffs, mixes, aerates sand. Height 4'6", weight 250 lbs., 1/3 H.P. enclosed motor.





TYPE "HL". Price $315.00 complete, less sieves. Laboratory model especially designed for laboratory sand control, fitted with 1/6 H.P. enclosed motor.

PROMPT DELIVERY from your Foundry Supply House

TYPE "V". Price, 20" Sieve, $330.00. Does the work of 10 men. Screens sand, Fine, Medium, and Coarse. 20" dia. sieve with special clamp for 5-second changes. Height 4'6", weight 100 lbs., fully-enclosed 1/6 H.P. motor. Also available in Giant V-5 with 36" sieve for triple capacity . . . Price $600.00.

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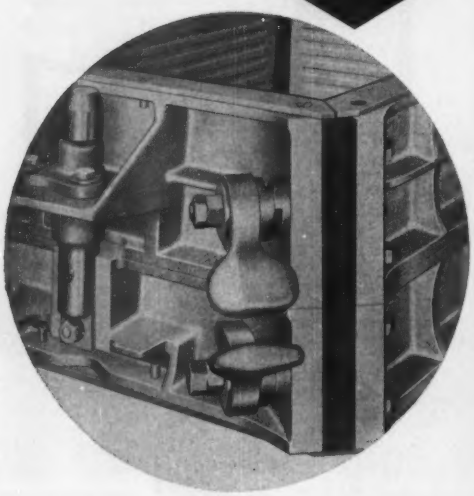
CITY STATE

Circle 671 on Page 39

TREMENDOUS CORNER STRENGTH



that's one of the secrets behind the popularity of FREMONT'S

SPREADLOCK FLASKS

Another secret of their popularity is the fact that they are made of magnesium. This makes them strong, yet light. Cams, however, are hardened steel forgings; they can stand a lot of banging around without damage. Write today for descriptions and prices.

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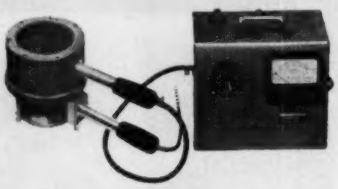
FREMONT
OHIO

Circle 672 on Page 39

Hydrogen Content Control
REDUCES REJECTS
with One Minute Foundry Test



Rejection of aluminum alloy castings, due to porosity, can be reduced through the use of one or more "HYCON TESTERS" in your foundry. The MEL model 5203 HYCON TESTER uses the "Initial Bubble Principle" to determine hydrogen gas content in molten aluminum alloy to an accuracy as close as ± 0.05 ml $H_2/100g$. Immediate and accurate control is thus available *before* casting. A simple operation requires but a minute. A small amount of molten alloy is ladled into the pre-heated electric crucible and pressure reduced at a controlled rate. When first bubbles break surface, temperature and pressure are noted and referred to a nomogram for precise hydrogen content reading.

A foundryman can make the test quickly and accurately with MEL model 5203 HYCON TESTER.

Meltronics, Inc.
1010 N. Main Street, Elkhart, Indiana
Phone, COngress 4-1116

Write for Complete information. Manufacturers Representatives solicited.

Circle 673 on Page 39

FOUNDRY CONSULTANTS

APPRAISALS . . . WAGE INCENTIVE PLANS . . . COST SYSTEMS . . . EXECUTIVE CONTROL . . METHODS PRODUCTION CONTROL SYSTEMS . . .

PLANT REMODELING . . PLANT DESIGN . . CONTINUOUS SYSTEMS . . . SEMI-CONTINUOUS SYSTEMS . . . PRESENT OPERATION MODERNIZED

EDWIN S. CARMAN, INC.
1645 LEE ROAD CLEVELAND 18, OHIO

Circle 674 on Page 39

NCP makes effective

PATTERN LACQUERS

1. Seals pattern to prevent moisture and water absorption.
2. Brushes easily—dries quickly.
3. Does not chip, peel, bubble, or blister, and is flexible.
4. Adds slip, promoting clean parting of pattern from sand.
5. Made in all colors.
6. Time tested material—successfuly used in pattern shops all over the country for over 30 years.

The National Chemical & Plastics Co.
1424 Philpot Street Baltimore 31, Maryland

Circle 675 on Page 39

Over 60 years
Service to Industry

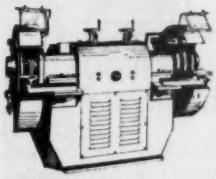
GRINDERS

EASIER, FASTER, MORE ECONOMICAL FOR ALL GRINDING OPERATIONS.

Swing Frame Grinder

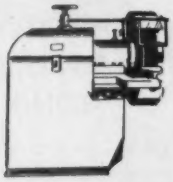
Portable 1/3 to 7½ hp

America's Greatest and Most Complete Line



Dual Motor Vari-Speed Grinder

Write for catalogs and new bulletins



Vari-Speed Single End Grinder

General Purpose Grinder

The United States Electrical Tool Co.

3640 LLEWELLYN ST.,
CINCINNATI 23, OHIO

Circle 676 on Page 39

EMPIRE*

"THAT GOOD" FOUNDRY COKE

DEBARDELEBEN COAL CORPORATION

2201 First Ave., North • Birmingham 3, Ala.

Phone: ALpine 1-9135

*Reg. U. S. Pat. Off.

Circle 677 on Page 39

Compare THE RINGLIFT with other Sand Conditioners—You'll See The Difference!

The Ringlift does not cut sand on the floor—it picks up the sand, cools, aerates and screens it, removes tramp iron magnetically, adds moisture and puts the sand back on the floor in neat windrows. Simple push button control. Today's most efficient, economical sand conditioner—get the facts!

STATES ENGINEERING CORPORATION

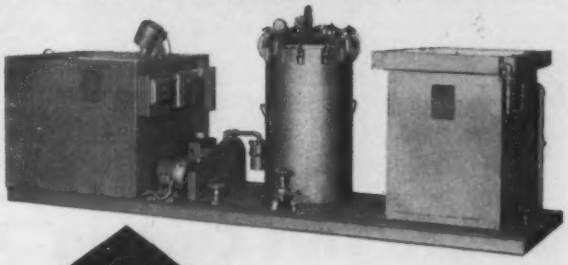
245 E. Murray St.
Fort Wayne, Indiana

SAND PREPARATION • MECHANIZATION • PLANT LAYOUT

Circle 678 on Page 39

CUT REJECTS

OUT OF YOUR COST PICTURE!



MOGUL PACKAGED-UNIT

HIGH VACUUM and PRESSURE IMPREGNATORS

IMPROVE PRODUCT QUALITY

MOGUL means dependable, thorough impregnating with Mogul cast seal or any other impregnating material including polyesters and phenolic resins.

MOGUL, because of extremely high vacuum, removes air and moisture for positive penetration of impregnant into parts. Following this vacuum action, applied pressure then assures still greater coverage and impregnation.

CHECK THESE MOGUL ADVANTAGES:

- COMBINATION high vaccum and pressure
- VERSATILE sizes and ranges: 2 to 100 cu. ft. as standard models 29" or more vacuum, 100 lbs. pressure
- THERMOSTATIC CONTROLS

PLUS:

READY-ASSEMBLED INSTALLATIONS that save work, time and cost

Just hook up complete packaged unit to your utilities and start operation!

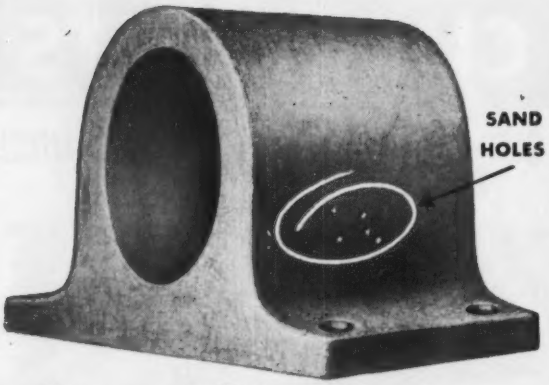
ASK ABOUT MOGUL CUSTOM DESIGNING & BUILDING

Phone SAcramento 2-3710 — or write

METALLIZING COMPANY OF AMERICA, INC.

3520 W. Carroll Avenue, Chicago 24, Illinois

Circle 679 on Page 39



Save This Casting *with* SMOOTH-ON FOUNDRY CEMENTS

Often a perfectly good casting has blow or sand holes, surface blemishes, or rough and porous areas that detract from its appearance. But there's no reason why it can't *look* as good as it really is.

Simply use Smooth-On Foundry Cement. It goes on easily, quickly . . . hardens rapidly at a predictable rate . . . stays firmly in place.

SHADINGS TO MATCH ANY CASTING

4A • Medium Gray
4AA • Light Gray
4B • Dark Gray

Quality Control That Assures You of Tight, Lasting Repairs

Every lot of Smooth-On Foundry Cement is laboratory tested for setting time, hardness and color. You can be sure of tight, lasting, good looking results every time, provided the directions are followed.

See how much better your castings will look after treatment with Smooth-On, known and used by leading foundries for more than 63 years. Try one or more of these cements at our expense. Write today—on your business letterhead—and we will send you free samples.

SMOOTH-ON MANUFACTURING CO.
570 Communipaw Ave.
Jersey City 4, N. J.

FREE SAMPLES

80-300

SMOOTH-ON FOUNDRY CEMENTS

Circle 680 on Page 39

HEAVY DUTY
MODEL K

SPECIALLY SUITED TO PRODUCE FERROUS AND NON-FERROUS LONG TUBULAR CASTINGS

Castings up to 32 inches in diameter and 20 feet in length. These machines are ideal for jobbing foundry work as well as production.

Cast tubes of all alloys of non-ferrous metal as well as cast iron, alloy irons, steel, alloy steels and stainless steels.

Highly efficient type of water-cooling for permanent molds.

Trunnion machines built in many size ranges for specific requirements.

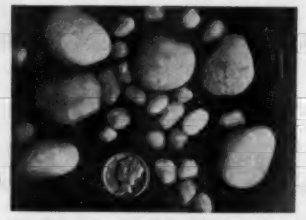
Illustrated Folder No. 160 Available on Request.

CENTRIFUGAL CASTING MACHINE CO.
P. O. BOX 947 TULSA 1, OKLAHOMA

Circle 681 on Page 39

HIGH QUALITY SILICA QUARTZITE PEBBLES

HIGH QUALITY • LOW ALUMINA



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R. W. SIDLEY, INC.
TELEPHONE CY 8-3232
THOMPSON, OHIO

Circle 682 on Page 39

SINCE 1919 A RELIABLE SOURCE of

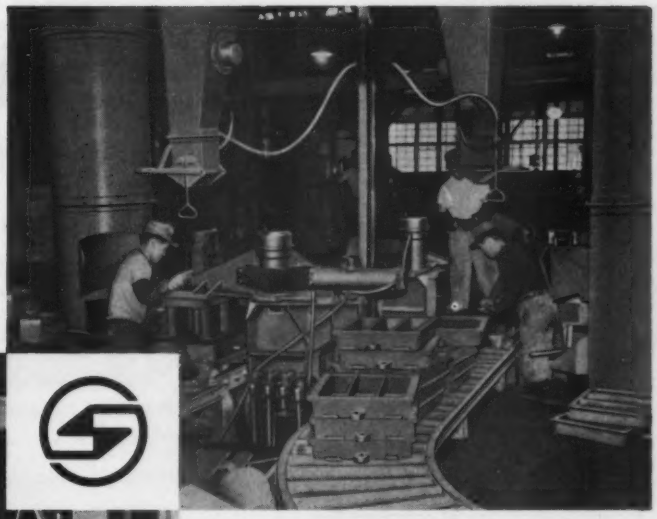
QUALITY PATTERNS, SHELL MOLDS, PERMANENT MOLDS AND DIE CASTING DIES.

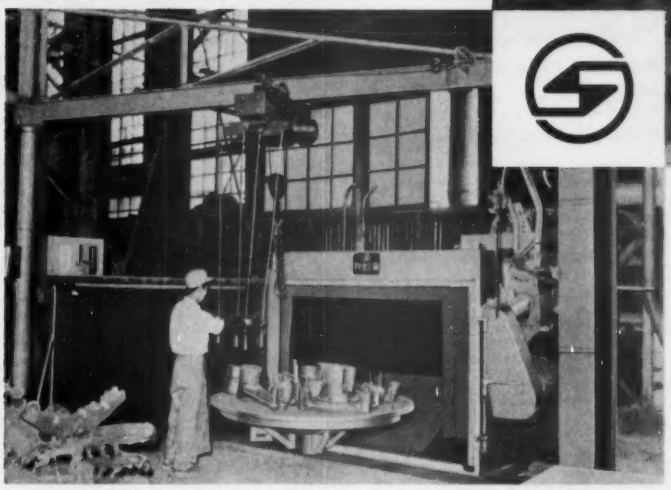
CENTRAL PATTERN CO.
QUINCY, ILL. TELEPHONE: BA 2-0947

40th YEAR AT THE SAME STAND

Circle 683 on Page 39

Progressive Foundries Specify SINTOKOGIO Equipment





Moulding Machines
Sand Preparing Machines
Shot Blasting Machines
Mechanized Foundry Equipment

Sintokogio, Ltd.

Showaku Nagoya Japan
Cable Address "SINTOKOGIO" NAGOYA

Circle 684 on Page 39

New in 1960!

MALLEABLE IRON CASTINGS

. . . . a comprehensive, authoritative handbook

Published by the Malleable Founders Society, this new 526-page handbook reflects the authoritative knowledge of the malleable industry's foremost foundry technicians and casting designers.

- It provides complete information on machining properties, metallurgical characteristics, and mechanical attributes of malleable iron castings
- Covers pearlitic malleable, newest of the malleables
- Describes new molding and production techniques
- Supplements the text with 300 photographs and charts
- Includes index, glossary, and bibliography

526 PAGES
300 ILLUSTRATIONS
6 x 9 IN., CLOTHBOUND
PRICE, $10.00

THE PENTON PUBLISHING COMPANY, Book Department, 1213 W. 3rd St., Cleveland 13, Ohio

Please forward one copy of MALLEABLE IRON CASTINGS postpaid.
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Please add 3% to cover state sales tax for deliveries in Ohio. (This volume is also available from our London office, 2 Caxton St., Westminster, London, S.W. 1, England)

Circle 685 on Page 39

CLASSIFIED ADVERTISING

• HELP WANTED

FOUNDRY MATERIALS

SUPERINTENDENT

The man for this job will have a degree in metallurgy and wide ferrous foundry melting experience. He will be looking for heavy responsibility in management, engineering, and cost areas. A progressive Indiana foundry and manufacturing company. Send full details in confidence on qualifications, area of interest, and salary to

BOX 723, FOUNDRY

PENTON BLDG., CLEVELAND 13, O.

ENGINEER

Internationally known foundry organization located in the East requires young graduate engineer for casting development and research work. Mechanical engineering background with basic metallurgical knowledge preferred. Address: Box 681, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT
$12000—$14000

For a modern foundry. Will consider top assistant.

FOUNDRY ENGINEER
$9000—$11000

Young engineer looking for assured future. CONTACT PAUL SHELDON in confidence

MONARCH PERSONNEL
28 EAST JACKSON BLVD.
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UNUSUAL OPPORTUNITY

for a resourceful, aggressive iron foundryman capable of progressively improving pattern equipment and operations in a captive manufacturing-jobbing foundry located in an attractive town in Hudson River Valley, New York. Must have management skill such that he can ultimately assume complete charge of all operations and management. Good labor conditions exist but need intelligent leadership and some sales ability. This can be a life-time career. Resume with salary requirements required in your response.

BOX 680, FOUNDRY

PENTON BLDG, CLEVELAND 13, O.

OPPORTUNITY IN DEVELOPMENT ENGINEERING for young agressive engineer with B.S., M.E. degree or equivalent, varied and challenging work with definite assurance that ability and accomplishment will lead to advancement. Midwest location. Send complete resume. Address: Box 705, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

PLANT ENGINEER

Thoroughly experienced in foundry design and layout. A major requirement is knowledge of modern material handling equipment and material flows. Degree is required and professional registration is an advantage. This is a real opportunity with an outstanding firm offering excellent salary and fringe benefits. Send complete information on education, work history and personal data. All replies will be held in the strictest confidence.

BOX 694, FOUNDRY

PENTON BLDG. CLEVELAND 13, OHIO

ABRASIVES

Experienced shot and grit service man. Contact foundries, steel mills, metalworking plants. Salary and commission.

BOX 699, FOUNDRY

PENTON BLDG. CLEVELAND 13, OHIO

• HELP WANTED

SUPERINTENDENT MALLEABLE FOUNDRY

Fully qualified superintendent for large foundry producing malleable fittings and automotive and agricultural implement castings at the rate of 1,000 tons per month. Preferred age 35-45. Send full details on experience, education and family status. All replies will be held in confidence.

BOX 695, FOUNDRY

PENTON BLDG. CLEVELAND 13, OHIO

FOUNDRY SUPERINTENDENT

. . to manage foundry operations for a company producing castings for its own use and embark on an expansion program. This position is of a permanent nature. Must be experienced in gray iron foundry and have knowledge of metallurgical practices and scheduling. Please submit complete resume and desired salary, in confidence, to:

T-98, P. O. BOX 2045

PHILADELPHIA 3, PENNSYLVANIA

METALLURGIST

For steel foundry in Pittsburgh area. Experienced in the production of electric furnace steel for railroad and miscellaneous castings. Require B. S. Degree in Metallurgy and practical experience in sand control, X-Ray, and the heat treating of castings. Send detailed resume, including salary required, educational record, work experience and references. Address: Box 709, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

INDUSTRIAL ENGINEER

Leading steel foundry located in Eastern Pennsylvania has challenging opportunity for young industrial engineer with responsibilities for all major practices such as standard data development and wage incentives, methods analyses and cost evaluations, etc. Excellent growth opportunities. Employment conditions, salary and benefits sure to be attractive to our man. Address replies and send resumes to: Box 684, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

GENERAL FOREMAN

Michigan jobbing foundry, producing large castings in gray and ductile iron requires General Foreman. Experience in dry and green sand molding, gating and feeding. Must have ability to organize and use initiative. Submit complete resume of experience, education and salary expected to Box 692, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

CUPOLA FOREMAN

Gray Iron Foundry in Camden, New Jersey. Must be capable of assuming complete responsibility of all cupola operations including supervision. Man with technical metallurgical training preferred. Please send complete personal information, experience and salary requirements. Address: Box 679, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• REPRESENTATIVES WANTED

SALES REPRESENTATIVE WANTED

Representatives wanted in the sale of a complete line of foundry equipment and supplies. Revecon and Reverbale Furnaces, Polford sand handling and mixing equipment, and Harmark foundry supplies. Initial sales have been established in every area. Write direct to: INTERNATIONAL FOUNDRY SUPPLY COMPANY, Box 1053, Reading, Pennsylvania.

REPRESENTATIVE WANTED

With following among ferrous foundries to sell established national foundry product for Michigan, Minnesota, Illinois, Wisconsin territory. Write complete background, experience. Address: Box 706, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• POSITIONS WANTED

FOUNDRY FOREMAN

Experienced foundryman with floor, machine molding, and core room supervisory experience. Stainless steel and iron. Green or dry sand molding. Versed in gating, risering, CO_2 core making and production procedure. Address: Box 718, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY EXECUTIVE—SALES OR MANUFACTURING

Young man, Engineering Graduate, sixteen years in steel foundry manufacturing and sales. Experience in alloy steels, stainless, 17-4PH, AM 355, Monels, ductile iron and Ni-Resist castings. Qualified in aircraft and missile quality castings. Knowledge of aircraft and atomic energy specifications, Magnaflux, dye penetrant and radiographic standards. Now employed. Address: Box 686, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

NONFERROUS FOUNDRYMAN

Twenty-two years in all phases of foundry operation. Journeyman moulder, jobbing and production work. Shell, CO_2 and oil sand cores. Also quotations and foundry management. Fifteen years in supervision. Will relocate. Address: Box 722, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

METALLURGIST

Broad acid and basic cupola melting experience, quality control of metal castings and sands. Age 49. Chicago or 50 mile radius preferred. Address: Box 719, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT OR MANAGER

Practical foundryman, nationally known for a job well done. Age 48. Good health. Now employed. Looking for more action ferrous or nonferrous. $15,000 minimum. Address: Box 707, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERVISOR—METALLURGIST

Young graduate metallurgist, experienced in gray iron and steel casting foundry practice, development, and supervision, seeks new position with opportunity. Address: Box 716, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

GENERAL FOREMAN OR FOREMAN

Thorough knowledge of steel foundry and cleaning room operations. This includes inventory and budget control. Experienced as Supervisor in all departments. Address: Box 702, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

ATTENTION!

If you are looking for an additional gray iron product to add to your operation to help outride your overhead and have capital to build inventory, I can furnish you Pattern Equipment. Desire position with company and percentage on sale of product under contract. Prefer an Ohio Location. Cored work. $200,000 yearly sales. Address: Box 704, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

PLUMBING SUPPLIES

General supervisor experienced in full operation of plumbing supply foundry. Capable of taking complete charge. Age 50, 32 years' experience. Address: Box 696, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

VERSATILE DIE CAST MAN

Graduate engineer trained in all phases of die casting including sales, administration, production, and engineering would like a man sized challenge in setting up a shop from scratch or improving an established one. Will accept temporary foreign assignment. Address: Box 682, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

WORK SIMPLIFICATION COORDINATOR

Twelve years' varied I.E. foundry experience. Specializing in work simplification, work methods and measurement, incentives, cost reduction project work. Have taught, trained and supervised others in these activities. Can design and implement related programs. Minimum salary $8,400. Resume on request. Donald Joynt, 405 Greenbriar Drive, Lufkin, Texas.

FOUNDRY SUPERVISOR

Young molding supervisor, some core room experience, with a complete foundry background, desires position with a possibility of advancement in a progressive shop. Address: Box 714, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT—MANAGER

Graduate metallurgist. Experienced in all types of ferrous foundry operations including incentives and budgetary control. Address: Box 715, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

PATTERN SHOP SUPERINTENDENT

Young man, experienced supervisor, production and jobbing foundry, pattern background. Desires to relocate. Address: Box 713, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• POSITIONS WANTED

MELTING FOREMAN—MELTER
Steel foundry, electric arc furnaces, basic or acid practice. Carbon, alloy and stainless steels. Capable of taking full charge, including budget and incentive systems. Address: Box 717, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MOLDING FOREMAN
Twenty years' EXPERIENCE in steel foundry. Floor molding and machine molding; Bumpers or slingers. All types castings to 20 tons. Address: Box 683, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

LICENSED STRUCTURAL ENGINEER
M.S. ten years' experience in design, detailing and construction of Steel Mill and Power Plants —foundations and multistory buildings, seeks design, drawing or field assignments. Address: Box 687, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MANAGER-SUPERINTENDENT
Age 45. 30 years' experience in all phases of gray iron foundry. Proven ability in ductile and high strength gray irons, basic and acid cupolas, jobbing or production. Address: Box 712, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT
Technically, practically and administratively experienced in producing grey iron, ductile, malleable and steel. Presently employed. Will consider overseas assignment. Address: Box 685, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT
Thirty-four years' experience, ferrous and nonferrous practical and technical, twenty years' supervisor. Prefer small shop. Now employed. Age 55. Address: Box 701, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

SUPERINTENDENT—MANAGER
27 years' practical and technical experience in all types of ferrous and nonferrous foundry operations. 20 years' supervisory experience. Sales and metallurgical background. Age 47. Now employed. Address: Box 700, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

PLANT ENGINEER
Nineteen years' top experience in all phases: Methods, Plant Layout, Construction, Plant Engineering, Maintenance, Automation and Material Handling. Aggressive, personable individual seeking a strong challenge in sales or engineering. Domestic or Foreign assignment acceptable. Address: Box 691, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY SUPERVISOR
Experienced in all departments of foundry. 20 years as supervisor, from foundry foreman to general superintendent. Prefer malleable job shop, will relocate. Address: Box 720, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

MANAGEMENT ASSISTANT
Thirteen years' experience in aluminum, copper, and gray iron jobbing and semi-production foundries. Experience in time studies, incentives, standard data and cost, estimating, production and purchasing. Address: Box 721, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

GRAY IRON FOUNDRYMAN
With proven record would like to make change. Now employed. Will relocate. Address: Box 703, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• FOUNDRY CONSULTANTS

FOUNDRY CONSULTING
Specialists in pressure cast pattern production using plaster molds. We offer a complete service. Consultation to appraise and improve your operations; furnishing new equipment or complete plants turned over to you on a turnkey basis. Address: Box 689, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY CONSULTANT—FERROUS
Are you having scrap trouble, cupola, molding sand, cores . . . . . I can cure them. Address: G. C. (JACK) COLE, 1629 Roys Avenue, Elkhart, Indiana

FOUNDRY CONSULTANT—NONFERROUS
Sand casting—permanent mold casting—centrifugal castings—in aluminum, brasses, bronzes, 30% leaded bronze—aircraft quality bearings and castings. Address: ED JENKINS, West Palm Beach, Florida. PHONE: TEMPLE 2-8685.

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GRINDING WHEELS
USED OR BROKEN Silicon Carbide Grinding Wheels of any kind or size regardless of Bond. Will pay top price. Address: UNION MINING COMPANY, 2306 First National Bank Building, Pittsburgh 22, Pennsylvania.

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National Placement and Procurement of
GENERAL AND PLANT MANAGERS, PLANT SUPERINTENDENTS, FOREMEN—ALL DEPARTMENTS, METALLURGISTS, ENGINEERS, CONTROLLERS, ACCOUNTANTS, SALESMEN, SALES MANAGERS, PERSONNEL DIRECTORS, PURCHASING AGENTS
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For Fast Competent Assistance Contact
DRAKE PERSONNEL, INC. **FINANCIAL 6-8700**
JOHN COPE, DIRECTOR, 20 E. MADISON ST., CHICAGO 2, ILL.

• FOUNDRIES WANTED

FOUNDRY WANTED
GROUP OF FOUNDRY ENGINEERS AND INDEPENDENT MANUFACTURERS WANTS TO PURCHASE FOUNDRIES (FERROUS AND NONFERROUS) WITH OR WITHOUT PROPERTY. PLEASE SUBMIT COMPLETE DETAILS AS TO CAPACITY, TYPE OF PRODUCTION, FOUNDRY EQUIPMENT, FLASK INVENTORY.
PRINCIPALS ONLY
ALL REPLIES CONFIDENTIAL
BOX 710, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

FOUNDRY—WANTED—EQUIPMENT
Foundry investment organization needs used equipment to activate and mechanize a large foundry. Complete foundry with or without property will be considered. Please be specific as to price and when inspection can be made. Principals only. All replies confidential.
BOX 711, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

SMALL FOUNDRY WANTED
Three or four-man brass foundry wanted in or around Cleveland, Ohio. Send complete particulars in confidence to Box 697, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• OPPORTUNITY

BRITISH COMPANY
MANUFACTURING AND SUPPLYING FOUNDRY EQUIPMENT WITH ALREADY ESTABLISHED CLIENTELE THROUGHOUT UNITED STATES WISHES TO CONTACT AMERICAN COMPANY WITH A VIEW TO MERGING INTERESTS. APPLY: BOX 708, FOUNDRY, PENTON BLDG., CLEVELAND 13, OHIO.

• FOUNDRIES FOR SALE

SMALL GRAY IRON FOUNDRY
Modern equipment, nice home included and other extras. Plenty of land for expansion. Detroit, Michigan area low down payment. Opportunity for experienced foundryman. Address: Box 698, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

ALUMINUM OR BRASS FOUNDRY
For Rent or Sale—Generous Terms—Partially Equipped. Fine brick building. Excellent condition. Molders available. Location is EASTERN PENNSYLVANIA. Address: Box 688, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY FOR SALE
Fully equipped now operating gray iron foundry in Western New York State for sale. Due to illness and age present owners want to retire and settle an estate. Any reasonable offer considered.
BOX 693, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

• FOR SALE

HARDWOOD FOUNDRY WEDGES
Standard and special sizes made from finest Oak and Hickory, packed in burlap bags. Reasonably priced. Address: Western Wheelbarrow Mfg. Company, (Established 1895) South Fort Smith, Arkansas.

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GOOD USED
FOUNDRY EQUIPMENT

SPO Model 9546 Jolt, Rollover, Draw, squeeze machine late model
INTERNATIONAL Rollovers 30 x 8
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DAVENPORT Rollover model 34A Table 36 x 60
SPO Rollovers
INTERNATIONAL Jolt Pin Lifts all sizes
J & J Jolt Pin Lifts model 8128 Table 30x38
SPO Rollover Pattern Draw Model RD 6815 table 36 x 68 draw 15"
INTERNATIONAL Plain Jolt machines
INTERNATIONAL Core Blower SB11 and SB13
CHAMPION Model CB10 Core Blower
DEMMLER Core Blowers all sizes
REDFORD Core Blowers all sizes
SIMPSON No. 1 Muller Model UD
SIMPSON #1½ UD
CLEARFIELD 404 Muller
SIMPSON #1—open gear
PANGBORN Table Cleaning Machine Model LG6 with Aux. Tables 24" and Dust Collector
Dust Collectors—Many Sizes
WHITING Coal Pulverizers Model 30 and 30A
FISHER Aluminum Melting Furnace 300# Motorized Nose Pour, Gas Fired
INDUSTRIAL BRIDGE Cranes Motorized 1 ton Capacity 26' Span
INGERSOLL RAND Cupola Blower Centrifugal 5200 CFM, 20 oz. with 40 Hp. Motor
BONDACTOR Model 1000L
Charging Cranes Monorail Type
TABOR Cut Off Saws
R-C Blower 18 x 54—7100 CFM 24 oz.
ROTOBLAST Model 14 GK w/dust collector
TESSMER Sprue Cutters
Ladles . . . All sizes open and enclosed gear
Steel Flasks Many Sizes
Air Hoists 500 lb. to 4000 lb.
Core Ovens, Drawer and Batch

B & P TRACTOR TYPE SLINGER
MANY MORE ITEMS AVAILABLE
WE SOLICIT YOUR INQUIRIES
WE BUY . . . SELL . . . TRADE

C. GREENE EQUIPMENT CORPORATION
4014 WEST 24th STREET
CHICAGO, ILLINOIS
LAFAYETTE 11322

FOR SALE
CLEARFIELD MULLER Model 610 with air operated discharge and in excellent operating condition. This machine was rebuilt at factory in 1953 and not put back into operation until 1957. Address: Pioneer Foundry Company, 607 Water Street, Jackson, Mich.

FOR SALE
One Model 3 Unit Drive Simpson Muller, with Bucket Loader, Double Discharge Hoppers, Mill Belt, Bucket Elevator, National System Aerator, 14 ft. long Prepared Sand Conveyor, 50 ton Sand Storage Bin. All in good condition. Address: Box 690, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• FOR SALE

FOUNDRY LIQUIDATION

Coleman #4 Junior Rolling Drawer Core Oven
Simpson Porto Muller
Simplicity Portable Screening & Aerating Unit 2' x 3' Model "C"
B & P Mulbaro #3½
Whiting 16" bottom radius x 54" long—"U" type mixing ladle
Cupola 60" diameter Shell
Ingersoll-Rand Blower Type FS-345, 3000 CFM—1# pressure
Bondactor Model #1250-S
Reda Melting Furnace—Series—1000
For complete listing of FLASKS, RAMMERS, LADLES & OTHER MISCELLANEOUS EQUIPMENT—WRITE:

THE COEUR D'ALENES COMPANY
BOX 909
300 CFM—1# pressure

FOR SALE
MOTOR-GENERATORS
TRANSFORMERS
Unused—Rebuilt
WORLD'S LARGEST INVENTORY
ELECTRIC EQUIPMENT COMPANY
Phone station Collect CL 4-9058
P. O. Box 51 — Rochester 1, New York

SAND BLAST EQUIPMENT
SELL—BUY—TRADE
GUARANTEED MACHINES
TERMS: 3 YEARS TO PAY

Specialized Wheelabrators and Pangborns converted to your requirements.

6' Pangborn Swing Table	$6000.00
Pangborn GF2 Air bbl.	$ 450.00
Pangborn 1CF Air bbl.	$ 350.00
Pangborn 53 EN-2 Hand cabinet	$ 325.00
Pangborn Auto Peening cabinet	$1100.00
48 x 48 Wheelabrator Tumblast	$3000.00
42 x 48 Wheelabrator Tumblast	$2000.00
27 x 36 Wheelabrator Tumblast like new	$4000.00
36 x 42 Wheelabrator Tumblast	$1500.00
27 x 36 Wheelabrator	$2750.00
4' Wheelabrator Table Blast	$2000.00
6' Wheelabrator Table Room	$6000.00
4' Wheelabrator Table Room	$3000.00
6' American Tablast	$2200.00
Rumelin 8 x 8 room	$1000.00
Pressure Tanks, all types	$150.00 up
Vapor Blast cabinets	$ 400.00
Vapor Blast Automatic Table	$3000.00

All types and sizes of Hand Cabinets, Dust Collectors, Pressure Tanks, Rooms, Horizontal or Vertical Tumbling Barrels and additional Sand Blast Equipment too numerous to mention.
$100,000 worth of Wheelabrator and Pangborn Spare Parts Priced 25% to 50% Less List.

DIAMOND SALES, INC.
5654 W. JEFFERSON
DETROIT 9, MICHIGAN
VI. 3-6750

• FOR SALE

REPAIR AND REBUILDING SERVICE ON ALL PNEUMATIC TOOLS

We try to carry a complete line of "Hard Chrome Rebuilt Tools" at about half the cost of new tools. Before you discard your old tools, why not send them to us for our estimate on the cost of renewing them with our Hard Chrome Process?

CENTRAL PNEUMATIC SERVICE, INC.
512 LINDEN AVENUE
DAYTON 3, OHIO
PHONE: CL 2-2701

FOR SALE

Ingersoll Rand 2 Cyl. 6 x 6 compressor.	900.00
Royer Sand Cutter 8" belt	300.00
Royer Sand Cutter 12" belt	450.00
Royer Sand Cutter 15" belt	700.00
Clearfield 610 Muller	800.00
Muller Mixer (paddle mixer)	250.00
I.B.M. Time Clock (bell ringing)	125.00
C.B. 5 Coreblower	350.00
Stock core machine (like new, with stand)	300.00
Magnetic pulley 15" x 22, never used	550.00
2—Tabor Top Squeeze Jolt (like new)	500.00 ea.
Tabor Rollover (overhauled) 22 x 42 table	700.00
500' Roller Conveyor (never used) 16"	1.50 ft
H.A. Payloader ½ yard	800.00
Master 190-portable oil heat blower	200.00
Master 400-portable oil heat blower	400.00
8—oil burning Salamanders	10.00 ea.
18' Bradley 2-chain elevator, 5 H.P. gas	275.00

DANVILLE FOUNDRY CORP.
DANVILLE, PENNSYLVANIA

FOR SALE

GARDNER #7½ 30" Wheels Dbl-End Vertical Grinder—Good Buy

PREPARATORS (2) #60 Model—one like new, one older—bargains

MOULDER'S FRIENDS (2)—one 60" w/extra brush, and one 50" w/extra brush—both guaranteed satisfactory

HOUGH Payloaders (2) Both Rebuilt and Guaranteed—½ Yd. Capacity, No-Tat or Pneumatic Tires

"Buying Good Used Equipment Is Often the Difference Between Having Needed Equipment—or Doing Without".

W. O. McMAHON
P.O. BOX 5799, HOMEWOOD STATION
BIRMINGHAM 9, ALABAMA
PHONES TREMONT 1-2088 or 9-6170

FOR SALE

27" x 36" American Wheelabrator, Serial Number A63376. Address: Weldon F. Stump, 4835 Crestridge, Toledo 13, Ohio.

• FOR SALE

GOOD USED FOUNDRY EQUIPMENT FOR SALE

OSBORN #3131 Roto-Lift—very late
OSBORN #3161 Roto-Lift—very late
OSBORN #276 Squeezers
OSBORN #275 Squeezers
OSBORN #210 Squeezer
J & J #918 Jolt Rollover
TABOR 30" x 40" Jolt Rollovers
INTERNATIONAL #24G Jolt Rollover
J & J #612 RC Jolt Rollover—late
J & J #681 Jolt Pin Lift
SPO #2114G Jolt Squeeze Pin Lift—late

B & P MOTIVE JR. SANDSLINGER Extra Head
SIMPSON #1½ Muller-Style C
SIMPSON #2 Muller-Style C
SIMPSON #2 Muller-Style UD
B & P #40 Speedmuller
CLEARFIELD #404 Muller
CLEARFIELD #610 Muller
B & P #S, #M, #L, Screenerators
PENN Dump Buckets

WHEELABRATOR TUMBLAST 27" x 36" w/Dust Collector
SPENCER Turbo Blower 30 H.P.—20 oz.—3500 cfm
DEMMLER #1 Core Blower—like new
ALLIS-CHALMERS Fork Lift—4000 lb. pneumatic—very late
DETROIT 10000 lb. Air Hoist w/Trolley—like new
I-R 4000 & 6000 lb. Air Hoists

BUY—SELL—LIQUIDATE
PEK MACHINERY CO.
1054 GARFIELD AVENUE—HE 2-4262
JERSEY CITY 2, NEW JERSEY

FOR SALE

One "San-Blo" Core Blowing Machine
Model #40-P1-LPP
18" x 24" Table Size
LIKE NEW CONDITION
BEAVER VALLEY ALLOY FOUNDRY CO.
MONACA, PENNSYLVANIA

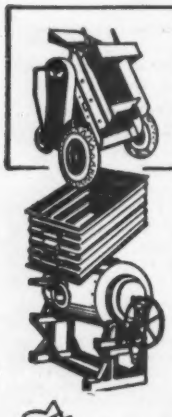
FOR SALE

1 Shalco Shell Core Blower MC-5 Serial #292	$1200.00
1 Shalco Shell Core Blower MC-5 Serial #191	600.00
1 Large Tumbling Barrel complete with unit drive (can be bought without drive)	400.00

PIONEER FOUNDRY & MFG. CO., INC.
GILBERTVILLE, MASSACHUSETTS

USED EQUIPMENT

(2) Wheelabrator Cabinets . . . 18' table w/dust collector. 36" Stack Fans, w/motors. Haiss Car-unloader. Double Hopper w/2 syntron vibrators. 30' Rex bucket elevators, w/drive. Address: SOUTHERN FOUNDRY SUPPLY, INC., P. O. Box 566, Chattanooga, Tennessee. Phone: AM-7-6785.



EUCLID FOUNDRY & MACHINE EQUIPMENT CO.

14919 SARANAC ROAD — CLEVELAND 10, OHIO

CLEANING EQUIPMENT
1—72" Swingout table
1—96" Swingout table
3—6 cu. ft. Continuous Tumblast
1—42" x 48", 17½ cu. ft. Tumblast with loader
1—36" x 42", 11½ cu. ft. Tumblast
1—6' Table Airblast w/six aux. tables
1—5' Table Airblast w/six aux. tables
1—6' Table Pangborn LE

COPE and DRAG UNITS
Automatic Controls
21" squeeze cylinders
1—215 Milwaukee
1—217 Milwaukee
2—TDA-4 Taccone 24"x24"

ELECTRIC FURNACES
1—3000 lb. Heroult Side Charge
1—500 lb. Lectromelt

MULLERS
Simpsons #2, 3, unit drive
Clearfield #404, 610

LADLES-WHITING
4—25 Tons 2—15 Tons 2—10 Tons

CORE OVEN
1—Di-Electric Model M800-A Thermonic, 30 KW

SANDSLINGERS
1—B-P 22" head stationary, R&L arm
1—B-P 19" head stationary, double belt
1—B-P 19" stationary, riddle type

ASK FOR OUR COMPLETE LISTING—CALL GLENVILLE 1-1222

DEPENDABLE SERVICE
QUALITY EQUIPMENT
GUARANTEED SAVINGS

PARTIAL LISTING OF EQUIPMENT NOW AVAILABLE — INQUIRIES INVITED

CUPOLA BLOWERS

INGERSOLL RAND

MODEL	C F M	PRESSURE	HP
FS-337	3000	20 oz.	25
FS-365	4500	16 oz.	30
FS-355	6000	16 oz.	40
FS-387	10,200	20 oz.	75
FS-377	10,500	20 oz.	85
FS-565	14,100	40 oz.	200
ROOTS CONNERSVILLE			
RCR	1040	20 oz.	10
RCS	9075	32 oz.	100
SPENCER TURBO			
2025H	1850	32 oz.	25
Cont.	7500	48 oz.	150

PANGBORN LK-6' Dia. Table-Room Rotoblast, Max. height of work 36", max. weight on table 5000 #. Table speed 2.4 RPM. Pitless type. New 1952. Serial #6LK-5110.

SAND MULLERS

CLEARFIELD

MODEL	PAN DIA.	CAPACITY
404	4'	400 #
610	6'	1500 #

BEARDSLEY & PIPER

MODEL	CAPACITY	AIR COOLED
30	4 cu. ft.	Yes
30	4 cu. ft.	No
60	12 cu. ft.	Yes
60	12 cu. ft.	No
70	15 cu. ft.	No
80	20 cu. ft.	Yes

ALL CAN BE EQUIPPED WITH DUST HOODS, SKIP HOIST LOADERS, MULTRAMATIC CONTROLS, ETC.

2—B&P #3½ Mulbaros.
1—SIMPSON Porto-Muller.

SIMPSON

MODEL	PAN DIA.	CAPACITY	DRIVE
0	3'	175 #	Sep.
1-H	4'	500 #	UD
1½	4'-6"	700 #	UD
2	6'	1500 #	UD
2	6'	1500 #	Encld.
3	8'	3000 #	UD
3	8'	3000 #	Encld.
3½	9'-3"	5000 #	UD

ALL CAN BE EQUIPPED WITH NATL. ENG. STRAIGHT LIFT SKIP HOIST BUCKET LOADERS.

LANCASTER

MODEL	PAN DIA.	CAPACITY
EA4	59"	9 cu. ft.
EBG-4	59"	9 cu. ft.

JOLT SQUEEZE PIN LIFT MACHINES

MODEL	TABLE SIZE	DRAW	DIA.	CAP.
PKL-12	18" x 24"	5¼"	12"	600 #
PKL-14	20" x 28"	5¼"	14"	1000 #
PK-16	20" x 30"	8"	16"	1700 #
MILWAUKEE				
125	21" x 27"	8"	12"	1200 #
145	24" x 30"	8"	14"	1700 #
195	28" x 39"	10"	19"	3000 #
196	16¾" x 39"	10"	19"	3000 #
244	22" x 32"	12"	24"	3000 #
245	35¼" x 42"	12"	24"	5900 #
246	23¼" x 42"	12"	24"	5900 #
OSBORN				
710-PJ	16" x 25"	6"	10"	500 #
712-PJ	18" x 28"	6"	12"	750 #
714-PJ	20" x 31"	7"	14"	1000 #
716-PJ	22" x 34"	7"	16"	1250 #
SPO				
2114-P	20" x 27"	4"	11"	600 #
2136	21" x 30"	6"	13"	800 #
2146	23" x 31"	6"	14"	1000 #

JOLT SQUEEZE ROLLOVER DRAW

MILWAUKEE

MODEL	TABLE SIZE	DRAW	CYL.	CAP.
167	32" x 33"	12"	16"	1000 #
OSBORN				
332	26" x 36"	9"	16"	750 #
333	32" x 45"	11"	19"	1400 #
SPO				
413-C	24" x 25"	10"	13"	600 #
917-A	28" x 36"	9"	17"	750 #

WHITING 10-TON HYDRO-ARC FURNACE

10' dia. shell, 6'-8" inside depth, 1" steel plate. Cradle tilt, manual & motorized, 9" dia. electrodes. Capacity—18 to 23 tons cupola malleable iron per hour. Holding capacity—16 tons normal, max. 21 tons.
1—ALLIS CHALMERS 2000 KVA Furnace Transformer. 12,000 volt primary, OIWC motor operated tap changer. Entire unit new 1952.

OSCILLATING CONVEYORS

AJAX ENGINEERING (Lo-Veyor)

MODEL	SIZE	CAPACITY in T P H
LC 18-6-24	18" W x 24' L	50
LC 24-6-7	24" W x 7' L	70
LC 24-6-21 FA	24" W x 21' L	70
LC 36-6-9DA	36" W x 9' L	100
LC 36-6-14 DA	36" W x 14' L	100
HEWITT-ROBINS		
VC-6	24" W x 120' L	55
VF-3	30" W x 5' L	12
LINK BELT		
Flexmount	8" W x 70' L	15
SIMPLICITY ENGINEERING		
OA-10-JA	24" W x 13' L	150
OA-10-JA	24" W x 11' L	150
OA-10-JA-2	30" W x 7' L	150
OA-10-JA	30" W x 13' L	100
OA-10-JA	36" W x 6' L	150
OA-10-A	36" W x 10' L	200
OA-10-A	36" W x 16' L	200
OA-10-A	36" W x 25' L	600

SANDSLINGERS

B&P Stationary, Model "DB," 5' jib arm, 4' ram, 19" head, 5" cup, 2-speed, 20/13 HP. Raising & lowering arms or fixed.
B&P Stationary, Model "DB," 8' jib arm, 4' ram, 19" head, 4" tip, 20/16 HP. Raising & lowering arms or fixed.
B&P "Motive Jr.," 11' jib arm, 4' ram, 16" head, 4" cup, R & L arms. 2-speed, 20/13 HP.
B&P "Motive," 15' jib arm, 9' ram, 2-speed, 25/16 HP. With Raising & Lowering

HANDY SANDYS

NEWAYGO SH8-4-G Super Handy Sandys, Single Hopper, 15 cu. ft. capacity, 4' receiving hopper, air gates, 21' center elevator.
NEWAYGO SH84-GT Super Handy Sandy, Twin Hopper, 25 cu. ft. capacity, 4' receiving hopper, 21' center elevator.
NATIONAL ENGINEERING Moulders Helper, Twin Hopper, 3000 # capacity, each air operated gates.

JOLT PIN LIFT MACHINES

DAVENPORT

MODEL	TABLE SIZE	DRAW	CAP.
34 A-JS	36" x 46"	12"	2500 #
INTERNATIONAL			
JDP 1200x8	24" x 26"	8"	1200 #
JDP 3000x10	48" x 48"	10"	3000 #
JL	32" x 52"	12"	2000 #
JOHNSTON & JENNINGS			
68-SP	25" x 30"	8"	600 #
812-S	30" x 38"	12"	1600 #
MILWAUKEE			
1030	28" x 34"	8"	1000 #
1536	32" x 38"	10"	1500 #
2036	32" x 38"	10"	2000 #
2542	38" x 42"	12"	3000 #
3548-6	44" x 46"	12"	3500 #
OSBORN			
540	32" x 52"	12"	2000 #
560	32" x 45"	12"	2500 #
SPO			
3070	26" x 35"	10"	1500 #

JOLT ROLLOVER PATTERN DRAW

DAVENPORT

MODEL	TABLE SIZE	DRAW	CAP.
24 BA	24" x 35"	12"	1000 #
28 BA	28" x 40"	12"	1500 #
34 A	34" x 58"	15"	2500 #
48 A	48" x 82"	24"	6000 #

1—INTERNATIONAL Model "AN," Air Clamp, Air Turnover, Air Draw-Molding Machine, 4500 # capacity. Flask—40" width by open ends. Draw 20". New 1952. Used six months.

JOHNSTON & JENNINGS

612	24" x 30"	12"	600 #
815	30" x 40"	15"	1200 #
918	44" x 54"	20"	2000 #
920-RC	44" x 54"	20"	2000 #
1020-RC	50" x 60"	20"	3000 #
OSBORN			
242-W	29" x 42"	12" to 19"	1500 #
244	35" x 52"	16" to 25"	3000 #
405	57" x 64"	26"	3000 #
442	21" x 31"	10"	600 #
601	24" x 30"	10"	900 #
602	30" x 36"	12"	1200 #
643	35" x 50"	20"	2000 #
SPO			
505	18" x 23"	6¼"	400 #
506	24" x 25"	10"	600 #
TABOR			
MODEL	TABLE SIZE	DRAW	CAP.
22"	22" x 32"	10"	600 #
22"	22" x 42"	10"	600 #
30"	30" x 46"	12"	1000 #
40"	40" x 60"	15"	3000 #

a MACHINERY AND EQUIPMENT COMPANY

"Built on a Foundation of Mutual Trust"

10900 CEDAR ROAD • CLEVELAND 6, OHIO • SW 1-3900

THE ACME BARGAIN PAGE

AERATOR
NEWAYGO

BLOWERS
I.-R. 12900 cfm, 100 h.p. 220-440 V, 20 oz.
GE 10500 cfm., 20 oz., 85 h.p., 220 V.
GE 7500 cfm., 20 oz., 89.6 h.p., 220-440 V.
SPENCER 7350 cfm., 16 oz., 50 h.p.
GE Centrifugal 6200 cfm., 24 oz., 58 h.p.
6000 cfm. INGERSOLL-RAND 32 oz.
SPENCER 3500 cfm., 28 oz., 40 h.p.
SPENCER 2250 cfm., 16 oz., 15 h.p., 220
SPENCER 1350 cfm., 32 oz.
NORTH AMERICAN 1050 cfm, 16 oz.
NORTH AMERICAN 850 cfm.
500 cfm. NORTH AMERICAN 12 oz.
McKee 200 cfm.

BUCKET ELEVATOR
33' Newaygo 12" x 7" Buckets
28' Newaygo 12" x 7" Buckets

CLEANING EQUIPMENT
27" x 36" American w/skip
48" x 48" AMERICAN w/skip
6' Table PANGBORN
#1 Rotary Table, AMERICAN
20" x 27" AMERICAN, w/rubber belt
AMERICAN #2 Tablast 8-28" tables, late
PANGBORN GD1-Airblast Barrel

CONVEYOR
17' BARBER GREEN Bucket Conveyor
30" x 25' Magnetic Belt Conveyor w/drives, 2 h.p., 220-440 V.

CONVEYORS, OSCILLATING
24" x 40' Ajax
SIMPLICITY 18" x 24'
SYNTRON 24" x 6'
AJAX 12" x 20'6"
36" x 11', Ajax
8" x 13' Ajax

CORE BLOWERS
CB15 55# cores, Universal blow plate
DEMMLER #4 up to 250# cores
DEMMLER #50
DEMMLER 2EO
DEMMLER 2K
FEDERAL "SAN-BLO" CB 40
INTERNATIONAL 8B15H, up to 150# cores. Hydraulic clamp and draw
INTERNATIONAL 8B 13, up to 60# cores
6—OSBORN 193 up to 50# cores
REDFORD #2 & #4

CORE GRINDERS
5—MILWAUKEE 70-9 & 70-12s

CORE OVENS
THERMONIC INDUCTION MODEL 1800A
2—Despatch ET. Drawer Type

CORE ROLLOVERS
INTERNATIONAL REDP Rollover 12" draw
SUTTER #500

CRANES
10 ton MILWAUKEE: 48' span, 220 V.

CUPOLA GUNS
1—Bondactor #1250 and 1000

CUTOFF SAWS
DEWALT CUTOFF SAWS for ferrous or nonferrous metals, cutoff or as sprue cutters. Flush blade adapter takes up to 20" abrasive blade or saw. Power Hoist to arm. Chain & Sprocket cross feed for working on heavy cast iron 48" x 60" "T" slot table or off table cutting of large work. Motor swivels horizontal to vertical in yoke.

DUST COLLECTORS
PARSONS 40,000 cfm, cloth bag type
ROTOCLONE W14 Arrang. A. 5200 cfm.

ELECTRIC MELTING FURNACES
1—DETROIT "LFA" 350 # shell 13200 V.
1—DETROIT "LFC" 700# and 350# Tapered Shell 2300 V.

FURNACES
400# Fisher Motorized Tilt, Gas Fired
600# Fisher Stationary
600# Campbell Hausfeld Brass

GRINDERS, MISC.
U.S. #70 Comb. 20" disc & 20"x3"x1½" wh
GARDNER 18" single end disc.
HANCHETT 30" double spindle opposed
GARDNER 26" D.E. Disc
Porter Cable BG 8 8" belt
72" Gardner Horizontal Disc
53" Hanchett Horizontal Disc

GRINDERS, SNAG
5—#6 FOX Single Wheel 24" Snag
U. S. #65 D. E. 30" x 3" x 12"

GRINDERS, SWING FRAME
FOX 24" x 3" x 12", 15 h.p.
MARSCHKE 24" x 3" x 12" 20 h.p., 220 V.
U. S. 24" x 3" x 12" 15 h.p., 220-440 V.
2—MARSCHKE 3 p.h., 12" wheel
1—B&D 7½ h.p.

HEAT TREATING FURNACES
G. E. Elevator Type 1950° Atmosphere Generator 65" x 16' car. Electric. Late
G. E. Elevator type 2150°—96" x 144" car atmosphere generator. Electric. Late
LINDBERG 1250° 48 x 60 Electric
3—ABBOTT 24" H x 22" Deep x 30" Wide, Gas Fired
HOLDEN #202 1850° Bright Hardening Annealing
25 KW Westinghouse 2000°

HOISTS
6000# Cleveland, w/monotractor travel
6000# Electrolift
4—2000# R & M
4—CLEVELAND 2000# Cab type hot metal carriers
1—500# Ingersoll-Rand LC-4

INDUCTION MELTING EQUIPMENT
100 KW-Ajax 300# 3000 cycle, 150 h.p. 4 bearings MS set, water cooled, complete controls
30 KW Lepel Spark Gap
35 KW Ajax Tama Wyatt, 60 cycle induction holding furnaces
1000# Ajax Spare Melting Furnaces

LADLES
WHITING 16000# Crane
WHITING 8000# Crane
WHITING 5000# Crane
4000# Industrial Holding

MOLD BLOWER
TACONNE TD4 24" x 32" flask

MOLD CONVEYOR
366'—51—44" x 66" cars

MOLDING MACHINES
JOLT SQUEEZE PIN LIFT
8—OSBORN 712 PJ 18" x 28" table
1—CHAMPION JSL10P 18" x 21" table 6" draw
8—MILWAUKEE 2646 Jolt Squeeze Strip rolloff—rolling molding machines 10" jolt cylinder; 1800# capacity, 26" Squeeze cylinder; 13" draw. Flask size 25½" to 29" wide, 52" long. FACTORY REBUILT.
2—MILWAUKEE 165, 24" x 30", 8" draw
JOLT SQUEEZERS
2—CHAMPION, JS10P 18" x 21" table
2—OSBORN 275PJ
2—MILWAUKEE 244 Jolt Squeeze car type head
MILWAUKEE 181-7, 24" x 36" table
113 PJ SPO
25—124 Milwaukee Portable Jolt Sq.
6—104 Milwaukee Portable Jolt Sq.
JOLT ROLLOVER DRAWS
HERMAN 3000#
2—750# HERMAN 20" x 30" table
1—INTERNATIONAL RJ 20" x 12"
1—SPO 9032
3—SPO 506
1—SPO 506 SP
2—INTERNATIONAL G
1—TABOR 30 x 52
JOLT SQUEEZE ROLLOVER DRAW
OSBORN 331-332-333
SPO 413D
INTERNATIONAL RES.
PLAIN JOLT
36" x 60" Herman

MULLERS and MIXERS
#30 B&P w/skip loader
1—#3 UD Simpson
1—930 Clearfield
CLEARFIELD #404
2—#2 SIMPSON OG
#1 Simpson OG
1½ Simpson Style "C"

SAND CONDITIONERS
AMERICAN 51"
ROYER NDC—ND2
SCREENARATORS S-M-L

SAND SLINGERS & EQUIPMENT
3—19"—2 speed Stationary
2—14' Turntables
1—12' Turntable
4—7' Plate Feeders, 35 & 45 Tons

SAND SYSTEM EQUIPMENT
33' Newaygo Bucket Elevator 12" x 7"
28' Newaygo Bucket Elevator 12" x 7"
4—7' B&P Plate Feeders, 35 & 45 Tons
2—18" x 52' Magnetic Belt

SAWS, BAND
30" LAIDLAW, Metal Cutting hydraulic

SHAKEOUTS
3' x 10' SIMPLICITY
5 x 10 LINK-BELT
4 x 8 LINK-BELT
2' x 8' Double Deck

SHELL EQUIPMENT
SHELL PRODUCTS 20" x 30" pattern size w/shell blender and bonding press
TSM4 Shell Molding Machine 20" x 30

SHOT BLAST
SLY #4, 20" x 30" w/dust collector

SLAG DISPOSAL UNIT
AMERICAN MODEL A

SPRUE CUTTERS
1—MILWAUKEE #85 TON
OBERMAYER 2 H.P.

STRAIGHTENING PRESS HYDRAULIC
225 ton Southwark
150 ton Farquhar "C" Frame
100 ton Elmes Hydraulic
100 tons Hannifin Hydraulic
60 ton Lempco 4 post
60 ton Farquhar "C" Frame
25 ton Fox
25 ton Dennison

TESTING EQUIPMENT
ARLIN Automatic Rockwell, continuous
COLEMAN 55 Spectrophotometer
GOGAN Model 1414-2V

TUMBLING BARRELS
ROTO-FINISH Model DW 45-36
1—ROYERSFORD, 42" x 72", chain drive
SLY, 24" x 48"; 3 H.P.
SLY, 30" x 60" Duplex

TUMBLING MILLS
30" x 60"

WOODWORKING—PATTERNSHOP
HERMANCE 24" Planer
JONES SUPERIOR 48" Double Disc
OLIVER #290 Dbl Arbor, Tilt-Arbor Saw
1—OLIVER 182D, 15" Disc Sanders
CRESCENT 24" planer
6", 8", 12", and 30" Jointers
20" Yates American Band Saw
36" American Band Saw

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ACME EQUIPMENT CO., INC.

We will buy for cash a single piece of equipment or your entire plant

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FOUNDRY ENGINEERING SERVICE

FOUNDRY EQUIPMENT BY FOUNDRYMEN

HAMLIN-NAGEL, INCORPORATED

Box 192, EDWARDSVILLE, ILLINOIS, *In Metropolitan St. Louis*, PHONE 3864

SAND SLINGERS
B & P Tractor type, 6' jib, 4' ram arm, 18" head.
B & P Stationary Riddle Type 6' Jib, 4' Ram Arm, 19" Head.

MECHANIZED MOLDING SYSTEM
Link-Belt 14 Station overhead Sand System, includes sand storage, muller, mold roller and pallet conveyors, oscillating shakeout conveyors and sand return

JOLT SQUEEZERS
Osborn 275J
International LJS 10"—12"
International PJS 16"
Tabor Top Squeeze 10"
SPO 110J—113J
Champion 10"
Milwaukee 104-5—10"—12"

JOLT SQUEEZE PIN LIFT
Milwaukee 126 Portable 21 x 27 Table 8" Draw
Milwaukee 145 24 x 30 Table 8" Draw
Osborn 712 18 x 28 Table 6" Draw

International PK18 18" Sq. Cyl 8" Draw 24 x 36 Table

JOLT ROLLOVER DRAW
International "G" 30 x 12
International "F" 45 x 72 x 16" Draw
J&J 612, 25 x 30 x 8" Draw
J&J 815, 30 x 40 x 15" Draw
J&J 918, 40 x 50 x 20" Draw
SPO 508, 28 x 30 x 9" Draw
Tabor 30 x 50 x 12" Draw Shockless

JOLT PIN LIFT
Davenport 34A, 36 x 46 x 12" Draw
J&J 1216S, 36 x 54 x 16" Draw
J&J 68S, 24 x 30 x 6" Draw
Milwaukee 1536, 32 x 38 x 10" Draw

JOLT SQUEEZE ROLLOVER DRAW

SPO 9546, 30 x 40 Flask 11" Draw
SPO 920, 32 x 44 Flask 11" Draw
Osborn 332, 26 x 36 Flask 9" Draw

PLAIN JOLTERS
J&J 72 x 72

SAND MULLERS
Simpson Porto-muller
Simpson #1½ UD
Simpson #2 w/skip (open gear)
Simpson #3UD auto-cycle, dust hood, etc.
B&P #60 w or w/o Multromatic
Clearfield 610
Clearfield 920 w/skip
Carver CO_2 Sandmixer 130# cap.

SAND CONDITIONERS
B & P Screenarators, M. L.
50" Molders Friend
Royer NDP, Royer NC2, Royer JR
American Sand Cutter, various sizes
B & P No. 60 Preparator

SHAKEOUTS
Simplicity 3 x 5
Simplicity 4 x 6
Allis Chalmers 4 x 6
Allis Chalmers 8 x 10

CORE BLOWERS
Redford No. 1 and No. 2
Champion, CB15, CB18
Demmler No. 1, 2K, 3E
Hansberg Shooter
Demmler 103EO w/feeder skip hoist, semi-auto cycle
Ross Vibra—Draws

CORE OVENS
Tower oven, various sizes
Batch type, Core & mold drying, various sizes
Porbeck 162B, 5 drawer double end
Foundry Equipment, single end, 5 drawer

CUPOLAS
Whiting 2½-4-5-6-8-9
Cupola Blowers, various sizes
Modern drop bottom skip hoist charger
Modern swivel charger
Hauck cupola lighter
Series 1000 Bondactor
Cupoliner Model 1500

LADLES AND POURING DEVICES
Modern, Whiting, all sizes plus mixing ladle, electric tilt, cylindrical and lip pour

NON FERROUS FURNACES
#60 to #250 Crucible & Iron Pot Furnaces, stationary and tilt
Lindberg Fisher Electric Induction
Reda 1000# power tilt type reverberatory
Stroman 1600#/hr. reverberatory, 1 station double chamber reverberatory

CLEANING EQUIPMENT

48 x 72 American Wheelabrator with skip and dust collector

42 x 48 American Wheelabrator
36 x 42 American Wheelabrator with skip & dust collector
27 x 36 American Wheelabrator with skip & dust collector
20 x 20 Air Blast Sly Barrel
No. 3 Pangborn continuous Wheelabrator with feeder & dust collector
36 x 72 Sly Tumbling Barrel, gearmotor drive

GRINDERS
Marschke 2 x 24
U.S. #65, variable speed 24"
Mumert-Dixon Swing 15 HP 3 x 24"
Gardner 36" opposed Wheel Surface grinder

AIR COMPRESSORS
25 H.P. Air Cooled I.R.
100 HP XRB Ingersoll-Rand 2 stage, horizontal
175 HP XRE 2 stage, synchronous motor

AIR HOISTS
Ingersoll-Rand 700#, 1000#, 2000#, 4000#, and 10,000#
Curtis Air Cylinder Hoists

ELECTRIC HOISTS
P & H 500#, 1000#
Comet 500#
Cleveland 1000#
Yale 1000#, 6000#

MATERIAL HANDLING EQUIPMENT
Hough Payloaders HA Models
Hyster Forklift 4000#
Clark Forklift 6000#
Towmotor Forklift 7000#
Baker Electric platform 6000#
D. C. Electric Clamshell 1½ Yard
Clamshell Buckets ¾ & 1 Yard
45" Bolted ECM Magnet
50" Bolted Ohio Magnet
55" Bolted Ohio Magnet

TESTING EQUIPMENT
Sand Testing Equipment

MACHINE SHOP EQUIPMENT
Cincinnati #118 automatic mill
Betts 52" Vertical Boring Mill, 2 loading arms
Niles Radial Drill 13" x 5' arm
American Radial Drill 14" x 7' arm
Welding Positioner, 6000# Cap.

MISCELLANEOUS EQUIPMENT
Sprue Cutters
Magnetic Pulleys
Steel Flasks
Slip Flasks, Jackets
500# Print-O-Matic Dial
American Rod Straightener Type F & H

WANTED! GOOD SURPLUS EQUIPMENT . . . . . .

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ALUMINUM INDUSTRIES INCORPORATED

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$1,500,000 VALUATION OF FOUNDRY—TOOL ROOM—&—PRODUCTION MACHINERY

Foundry Equipment consists of: cleaning department—core blowers—core ovens—core rollovers—misc. coreroom items—dust collectors—snag grinders—induction heating units—complete heat treating department—hoists—laboratory and test equipment—material handling equipment—reverberatory aluminum melting furnaces—molding machines—jolt pin lifts—jolt rollover draws—jolt squeezers—mullers—pattern shop—pig molds—sand systems—sand slingers—shakeouts—temperature recorder controllers—ALSO . . . Chipping tables—steel core plates—steel & graphite crucibles—handling equipment—aluminum and steel flasks . . . . and thousands of other items connected with foundry equipment.

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SALE UNDER MANAGEMENT OF: **THOMAS MACHINERY LIQUIDATING COMPANY, INC.**

1920 DIXWELL AVENUE **NEW HAVEN 14, CONNECTICUT**

Circle 870 on Page 39

LARGE MODERN STEEL FOUNDRY SALE

"Clean out everything by February 10th for New Manufacturing Facilities."

- THERMONIC Di-electric Core Oven w/40" W. mesh belt
- HEROULT 9' Elect. Furnace w/2000 KVA transformer
- CAR BOTTOM Annealing Furnaces, 1950°F.
- B & P Motive Speedslinger, 2 speed
- B & P Hydra-slinger, stationary, 2 speed
- JOHNSTON & JENNINGS #1020 RCX Rollover Patt. Draw
- BARTLETT & SNOW 300 ton Sand Storage System
- HYDRA BLAST System—Complete
- WET SAND Reclamation System—Complete
- PATTERN SHOP—Complete
- Flasks — Conveyors — Ladles — Dust Collectors

PLUS MANY MANY OTHER ITEMS

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ACT QUICKLY—BUY NOW

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SALE MANAGED BY: UNIVERSAL MACHINERY & EQUIPMENT COMPANY — READING, PENNSYLVANIA

Circle 871 on Page 39

universal MACHINERY AND EQUIPMENT CO.

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1632 North Ninth Street
Reading, Pa., Franklin 3-5103

• AIR COMPRESSORS

25 hp INGERSOLL-RAND water cooled, horizontal
75 hp INGERSOLL-RAND water cooled, horizontal
100 hp WORTHINGTON air cooled, 2 stage

• BLOWERS

CENTRIFUGAL 5 Hp to 30 Hp
GE, WILBRAHAM—GREEN FISHER Positive Pressure & Cent., Cupola Blowers

• BLAST CLEANING EQUIPMENT

Over 75 rebuilt Wheelabrator units sold in less than two years.

72" WHEELABRATOR Swing Table
15" Cont. WHEELABRATOR Tumblast
26" Cont. WHEELABRATOR Tumblast
15" x 20" WHEELABRATOR Tumblast
20" x 27" WHEELABRATOR Tumblast
27" x 36" WHEELABRATOR Tumblast
36" x 42" WHEELABRATOR Tumblast
48" x 42" WHEELABRATOR Tumblast
48" x 48" WHEELABRATOR Tumblast
1-A WHEELABRATOR Multi-table
No. 2 WHEELABRATOR Multi-table
WHEELABRATOR Pipe Cabinet
WHEELABRATOR Sheet Cleaning Machine, 48" wide stock
PANGBORN 8' LF Table
PANGBORN Air Blast Room 5' x 8'
6' LK PANGBORN Table Room
6' LG PANGBORN Table
DUST COLLECTORS AND SKIP LOADERS AVAILABLE FOR ALL MACHINES

Just received from Gov't storage
48" x 42" & 27" x 36" WHEELABRATORS with skip loaders & dust collectors
LIKE NEW . . . ACT QUICKLY

• CONVEYORS

CARRIER Oscillating, 18" W x 54' L
HEWITT-ROBINS Oscill. 18" W x 40' L
HEWITT-ROBINS Vibrating, 18" W x 10' L Model VC-1
LINK-BELT, Car type mold, 114 cars, 403' track, car size 18" x 42"
LINK-BELT Oscillating, 18" W x 13' L
SIMPLICITY 17" W x 11' L, Model OA-10-KA Feeder
SIMPLICITY 24" x 10' Feeder w/hopper, Model OA-10-JA2
Roller Conveyor—Ask for List

• CORE BLOWERS

DEMMLER #1, #2, #2A, #3K, #4E
INTERNATIONAL SB-13
OSBORN #91, #192, #91-10
RANDALL MODEL "A" Bench Type
SAN-BLO #40-P-1, 40# core
TACCONE #4D, 10" Draw Stroke Cyl.

• DUST COLLECTORS

COMPLETE STOCK—both Bag & Wet Types, 1000 to 15000 CFM

• FURNACES

DIRECT ARC MELTING

250 lb. LECTROMELT, Side Charge
500 lb. LECTROMELT, 200 KVA trans.
1000 lb. SWINDELL
2000 lb. HEROULT
2000 lb. SWINDELL, 3/60 1000 KVA
1½ Ton HEROULT
10' Top Charge Furnace

INDIRECT ARC MELTING

10# DETROIT
350# DETROIT LFA
750# DETROIT LFY, Conical Shell
1000# DETROIT AA
3000# DETROIT C, 500 KVA

INDUCTION MELTING & HEATING

30 KW, ECCO Hi-freq. Vacuum Melting
30 KW LEPEL, water cooled spark gap
35 KVA, AJAX 60 cy., alum.
35 KVA, AJAX Spark Gap, High Freq. steel
75 KW TOCCO

GAS & OIL FIRED

400# & 600# FISHERS, MNP
1000# HAUSFELD Hand Tilt, Oil fired, alum or magnesium
1—#900 JC STROMAN, gas, Like new
6000# STROMAN, gas fired
20 Gas & Oil Fired Furnaces

HEAT TREATING

4' x 4' x 10' Gas Fired Annealing
9' x 12' Car Type, gas/oil
210 KW LINDBERG conveyor box type
7' Rotary G.E. 200 K.W. 1950° F
36" x 36" West. Pit Type Electric
10" x 12" x 24" LINDBERG, 2500° F. Hyd
42" x 73' G.E. Roller Hearth, 1950° F.
48 x 120, 48 x 144 gas fired
Large Stock Gas Fired Box Heat Treating Furnaces

• PIT TYPE ANNEALING

42 x 96, 42 x 120 recirculating gas fired

• GRINDERS

DOUBLE END

3 Hp HISEY WOLF 3/60/220
5 Hp U.S. Model 64, 3/60/220
7½ Hp U.S. Model 66, 3/60/440
10 Hp STANDARD 3/60/440
15 Hp MARSCHKE 220 volt
25 Hp KLING 3" dia. shaft

PEDESTAL

3 Hp CLEVELAND 3/60/440
5 Hp CINCINNATI 2/60/440
15 Hp Model Class 1, 3/60/220-440

SWING FRAME

7½ Hp MUMBERT-DIXON 2/60/220-440
10 Hp SAFETY 24" x 3" wheel
15 Hp MARSCHKE 3/60/220-440
15 Hp MUMMERT—DIXON

• LADLES

BOTTOM POUR

MODERN, 49" x 49"
MODERN Crane Type, 55" H x 50" top
MODERN Crane Type, 60" H x 60" top

LIP POUR

WHITING 52" x 52" top dia. geared

CYLINDRICAL

WHITING, 26" L x 25" dia, 1100# iron
WHITING, 19" L x 22" dia, 600# iron
WHITING, 38" L x 28" dia, 2200# iron

• MATERIALS HANDLING

BYERS Mobile Crane, BUDA Engine, 50' Boom, 5 ton w/magnet & bucket
HOUGH PAYLOADER, Model HA, 1000# cap., hyd. lift, mech. dump

• MOLDING MACHINES

JOLT ROLLOVER PATTERN DRAW

DAVENPORT #3-8A w/air clamps, 34" x 48" table, 2500#
DAVENPORT #4-8A, 40" x 60" table, 3000#
HERMAN 10,000# 48" x 109" table
HERMAN 6000#, 42" x 78"
HERMAN 7500#, 40" x 50" table
HERMAN 3000#, 30" x 66" table
HERMAN 3000#, 32" x 70", 15" cyl. series charging conveyor type
HERMAN 1500#, 30" x 48" table
INTERNATIONAL 31" x 16", Type F, 28" x 31" table
INTERNATIONAL 30" x 12", Type G, 28" x 35" table
INTERNATIONAL 13" x 17" table
J & J #918, 40" x 48" table, 18" draw
OSBORN #602, 36" x 26", 900#
OSBORN #405, 3000#, flask 64" x 57"
TABOR 40" x 60", 1500 & 3000#
TABOR 22" x 42" pattern draw shockless, portable 600#
TABOR 20" x 30", w/air clamps, 1000#
TABOR 14" x 16" Rockover 150#
TABOR 40" x 50" table, 3000# capacity

PLAIN JOLT

INTERNATIONAL, 3' x 4' Table, 12" cylinder
TABOR 3' x 4' table

JOLT PIN LIFT

HERMAN #1317, 22" x 30" table
INTERNATIONAL JDP, 1200 x 8", 24" x 26" table, 8" draw, 1200# port.
SPO #305, 750 lb. 20" x 27" table
TABOR 20" x 24" table, 600#

JOLT SQUEEZE PIN LIFT

INTERNATIONAL PKL, 20" x 28" table, 14" sq. 5½" draw
INTERNATIONAL PKL, 18" x 24" table, 12" sq., 5¼" draw, stat.
MILWAUKEE #163, 15" x 24" table, 11" sq., 1500#
MILWAUKEE #165, 24" x 30" table, 16" sq., 1700#
NICHOLLS 18-44, 6¼" draw.
OSBORN, #712J, #712PJ, 18" x 28" table, 12" sq., 6" draw, stat. & port.
OSBORN #716 PJ, 22" x 34" table 16" sq., 8" draw
SPO #2114P, 21" x 27" table, 600#
SPO #2116, 21" x 27" table, 11" sq., 6" draw

JOLT SQUEEZERS

INTERNATIONAL #12 LJS, 16" x 20"
INTERNATIONAL #10 LJS, 16" x 20"
OSBORN #275J, 16" x 20" table, 400#
SPO #110J, 17" x 20" table 400#
TABOR Squeeze-In Head, 16" x 19" table
TABOR Yoke Type, 18" x 26" table

• MULLERS AND MIXERS

B&P #30 Speedmuller w/skip, 3 cu. ft.
B&P #40 Speedmuller w/skip, 5 cu. ft.
B&P #50 Speedmuller with cooling & multro-matic controls, 7½ cu. ft.
B&P Conventional, SIMPSON type, 87½" Dia., arranged for cooling
SIMPSON, #0, U.D., 3' Dia.
SIMPSON, #1, Sep. Dr., 4' dia., 4 cu. ft.
SIMPSON #1½, U.D., 4'6" dia., 6 cu. ft.
SIMPSON #1½, Sep. Dr., 4'6" dia., 6 cu. ft.
SIMPSON #2, enc. gear or open gear, 6' dia., 14 cu. ft.
SIMPSON #3, 8' Dia. Sep. Dr., 30 cu. ft.
SIMPSON #3, U.D., 8' dia., 30 cu. ft.
WHIRLMIX, 31" dia., 200 to 300 lb. sand

• OVENS

COLEMAN, Gas, 2 Comp. and 5 drawers, O.D. 22' x 12' x 10'
GIRDLER Thermex Dielectric Core Oven, 15 KW w/36" W mesh belt

• PRESSES

40 Ton FERRACUTE Sprue Cutter 1½" stroke
125 ton R.D. WOOD Down acting, 9" stroke
NIAGARA No. 82 Punch Press

• SAND CONDITIONING

B&P Nite-Gang
B&P Screenarator, Model "M"
LINK-BELT Revivifier
ROYER, NC-2, 10-15 tons/hr, 1½ Hp
ROYER PREPARATOR, Comb., Model NDC, 25 ton/hr scrap removal, 8' x 8' hopper
ROYERS, NDP, 15-25 tons/hr, 2 Hp
ROYER, "NRP," 40-60 tons/hr, 5 Hp.

Sand Handling System
NATIONAL ENGINEERING UNIT
Inc.: #1½ Simpson U.D. Muller w/water meter, National Screen Master Preparator, skip bucket loaders, 20"x20' belt conveyor, "Elevayor", 2 Moulder's Helpers (4 stations)—1957 unit LIKE NEW — LOW LOW PRICE!

• SAND SLINGERS

B&P Stationary, Single Speed
B&P Tractor Type, 16" Head
B&P Tractor Type 19" Head

• SHAKEOUTS

2' x 10' HEWITT-ROBINS
3' x 10' SIMPLICITY
4' x 5' SIMPLICITY
4' x 5'6" SIMPLICITY
4' x 6'6" SIMPLICITY
4' x 8' SIMPLICITY
5' x 8' HEWITT-ROBINS
5' x 8' HEWITT-ROBINS

• TESTING MACHINES

100,000 lb. Olsen UNIVERSAL Tensile
3000 Kg Gogan Brinell Testers

• TRANSFORMERS (Furnace)

100 KVA KUHLMAN 13,200, 1/60
250 KVA WESTINGHOUSE 6600, 3/60
300 KVA WAGNER 4600, 1/60
500 KVA KUHLMAN 13,200, 1/60
800 KVA PENNA. 23,000, 3/60
1000 KVA WESTINGHOUSE 23,000, 3/60
1000 KVA G E 13,200, 3/60
2000 KVA WESTINGHOUSE 13,200, 3/60
5000 KVA WESTINGHOUSE 2300, 3/60
7500 KVA PENNA. 13,200, 3/60

• TUMBLING BARRELS

SLY 68" x 32" round
SLY 48" x 36" round

• MISCELLANEOUS

BLASTCRETE Model PM-1 Cupola Gun
FLASKS, CORE PLATES, All Sizes
CLIMAX Model 2-A Wire Straightener
62" Magnet
MOULDER'S Hoppers, Various Sizes

Your *DEPENDABLE* Foundry Equipment Dealer

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This is a report that we continue to receive from our customers.

Standard melting kettles and machine pots direct from stock are available for all nonferrous metals.

Special pots are made to your specifications.

We also furnish the following parts in Tiffin alloyed iron or alloyed steel:

- ★ PLUNGERS
- ★ NOZZLES
- ★ GOOSENECK NOSES
- ★ THERMOCOUPLES
- ★ INGOT MOLDS
- ★ BAR STOCK

All parts are especially engineered to give the best possible service in the die casting field.

OVER 50 YEARS EXPERIENCE in the manufacture of quality pots and die equipment.

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Use The Best

THE TIFFIN FOUNDRY, INC.

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TIFFIN, OHIO

Circle 686 on Page 39

Advertising Index

Acme Foundry Co. 168
Adams Co., The 146
Air Reduction Co., Inc., Pure Carbonic Co., Div. 93
Ajax Magnethermic Corporation 120
Aluminum Co. of America 43
American Air Filter Co., Inc. 100
American Chain & Cable Co., Inc., Wright Hoist Division 27
American Optical Co. 137
American Steel & Wire Division of United States Steel 5
Ansco, A Division of General Aniline & Film Corporation 195
Applied Research Laboratories, Inc. 46
Arcair Co. 113
Archer-Daniels-Midland, Federal Foundry Supply Division 6, 7
Arrow Butt Corporation 214

Babcock & Wilcox Co., The, Refractories Division 48, 49
Baroid Chemicals, Inc. 180, 181
Bartlett, C. O., & Snow Co. ..... Back Cover
Basic Products Corporation, Hevi-Duty Electric Co., Division 97
Beardsley & Piper Division Pettibone Mulliken Corporation 125, 151
Beryllium Corporation, The 33
Brown Boveri Corporation 143

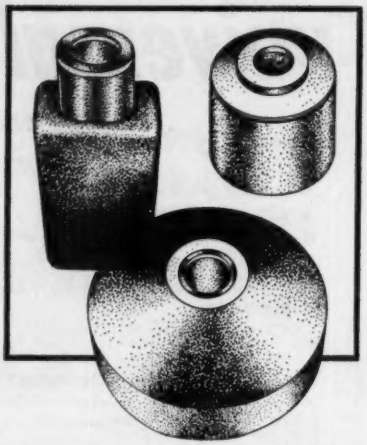
C & S Products Co., Inc. 14, 15
Carman, Edwin S., Inc. 202
Carver Foundry Products Co. 191
Cedar Heights Clay Co. 189
Central Pattern Co. 204
Centrifugal Casting Machine Co. 204
Chicago Manufacturing & Distributing Co. .. 150
Cincinnati Milling Machine Co., The 2
Clearfield Machine Co. 42
Cleveland Electro Metals Co., The 129
Cleveland Flux Co., The 175
Cleveland Metal Abrasive Co. 154
Cleveland Tramrail Division, The Cleveland Crane & Engineering Co. 185

DeBardeleben Coal Corporation 203
Detroit Electric Furnace Division of Kuhlman Electric Co. 110, 111
Detroit Mold Engineering Co. 36
Detroit Testing Machine Co. 192
Dow Corning Corporation 133
Durez Plastics Division, Hooker Chemical Corporation 156, 157

Eastman Kodak Co., X-Ray Division 99

Fanner Manufacturing Co., The 115
F. E. North America, Ltd. 139
Ferro Corporation, Louthan Manufacturing Co., Division 164
Foundry Equipment Co., The 44
Foundry Supplies Manufacturing Co. 155
Fremont Flask Co. 202

Garden City Fan Co. 136
General Aniline & Film Corporation, Ansco Division 195
Goodrich, B. F., Industrial Products Co. 9
Gordon, Claud S., Co. 140
Great Lakes Carbon Corporation 107
Great Western Mfg. Co. 201



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Over one half million have been used with complete satisfaction. Send for catalog on complete line of butts and peins. We feature 13 types. Sand rammer butts are our business, not our sideline.

ARROW BUTT COMPANY

4800 W. 139th St., Cleveland 35, Ohio

Circle 687 on Page 39

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By Charles W. Briggs

625 pages,

334 illustrations

Price $13.00 Postpaid

A comprehensive work giving detailed data on the chemistry, metallurgy and technology of steel castings. Provides complete information on methods of technical and industrial control in production of steel castings and describes every manufacturing process used.

FOUNDRY

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1213 W. 3rd Street
Cleveland 13, Ohio

Circle 688 on Page 39

Advertising Index

Hanna Furnace Corporation, The 50, 51
Hannifin Co., A Division of Parker Hannifin Corporation 54
Harbison-Walker Refractories Co. 11
Hartley Controls Corporation 200
Herman Pneumatic Machine Co. 178, 179
Hevi-Duty Electric Co., A Division of Basic Products Corporation 97
Hickman, Williams & Co. 169
Hines Flask Co., The 122
Hoeganaes Sponge Iron Corporation 173
Hooker Chemical Corporation, Durez Plastics Division 156, 157
Hough, Frank G., Co., The 12
Hunt Valve Co., Division of International Basic Economy Corporation 16

Imperial Belting Co. 94
Inductotherm Corporation 165
Industrial Equipment Co. 141
International Basic Economy Corporation, Hunt Valve Co., Division 16
International Minerals & Chemical Corporation, Eastern Clay Products 130, 131

Jeffrey Manufacturing Co., The 41
Johnston Manufacturing Co. 184
Joy Manufacturing Co. 105

King Tester Corporation 158
Kirk & Blum Mfg. Co., The 132
Knight, Lester B., & Associates, Inc. 163
Kuhlman Electric Co., Detroit Electric Furnace Division 110, 111

Lanly Co., The 162
Latella, D. C., & Associates, Inc. 200
Lectromelt Furnace Division, McGraw Edison Co. 55
Lindberg Engineering Co., Lindberg-Fisher Division 161
Lindberg-Fisher Division, Lindberg Engineering Co. 161
Louthan Manufacturing Co., A Division of Ferro Corporation 164

McGraw Edison Co., Lectromelt Furnace Division 55

Manhattan Rubber Division, Raybestos-Manhattan, Inc. 183
Marshall, L. H., Co. 200
Martin Engineering Co. 201
Master Power Corporation 35
Mayer, Carl, Corporation, The 22
Meltronics, Inc. 202
Metallizing Company of America, Inc. 203
Metal Blast, Inc. 170
Michigan Oven Co. 197
Milwaukee Chaplet & Mfg. Co. 32
Modern Equipment Co. 216
Murphy, James A., & Co., Inc. 198

National Acme Co., Shalco Division 119
National Chemical & Plastics Co., The 202
National Engineering Co. 148, 149
Newaygo Engineering Co. 56
Nomad Equipment Co. 10

Ohio Electric Mfg. Co., The 186
Ohio Ferro-Alloys Corporation 123
Osborn Manufacturing Co., The 102, 103

Pangborn Corporation 52, 53
Parker Hannifin Corporation, Hannifin Co., Division 54
Pasadena Hydraulics, Inc. 198
Penn Iron Works, Inc. 198
Permanent Mold Die Co. 8
Pickands Mather & Co. 167
Picker X-Ray Corporation 45
Pittsburgh Coke & Chemical Co. 28
Pure Carbonic Co., A Division of Air Reduction Co., Inc. 93

Raybestos-Manhattan, Inc., Manhattan Rubber Division 183
Redford Iron & Equipment Co. 193
Ren Plastics, Inc. 197
Reynolds Metals Co. 1
Robson Process Co. 199
Rydow Manufacturing Co. 201

Schneible, Claude B., Co. 34
Security Alloys Co., Inc. 192
Simplicity Engineering Co. 116
Sidley, R. W., Inc. 204
Sintokogio, Ltd. 205
Smith, Werner G., Inc. 128
Smooth-On Manufacturing Co. 204
Space-Ray Corporation 159
Speer Carbon Co. 152
Spo, Inc. 30, 31
States Engineering Corporation 203
Sterling National Industries 47
Stevens, Frederic B., Inc. .... Inside Back Cover
Superflux Mfg. Co. 158

Taylor, S. G., Chain Co., Inc. 144
Tiffin Foundry, Inc., The 214

Union Carbide Metals Co., Division of Union Carbide Corporation ..... Inside Front Cover
United States Electrical Tool Co., The 203
United States Graphite Co., The, Division of The Wickes Corporation 13
U. S. Smelting Furnace Co. 177
United States Steel, American Steel & Wire Division 5
United States Steel Export Co. 5

Vanadium Corporation of America 127

Wadsworth Equipment Co. 129
Warwick Industrial Furnace & Engineering Corporation 199
Wedron Silica Co. 145
Wheelabrator Corporation 24, 25, 194
Whitehead Brothers Co. 21
Whiting Corporation 135
Wickes Corporation, The, The United States Graphite Co., Division 13

Classified Advertising 206, 207, 208, 209, 210, 211, 212, 213

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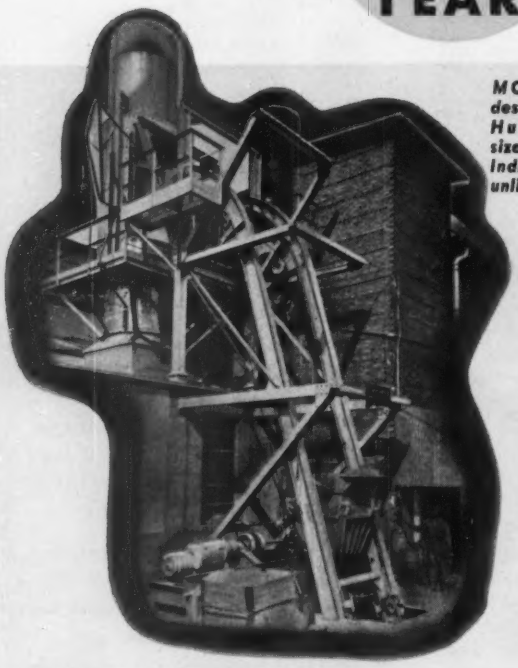

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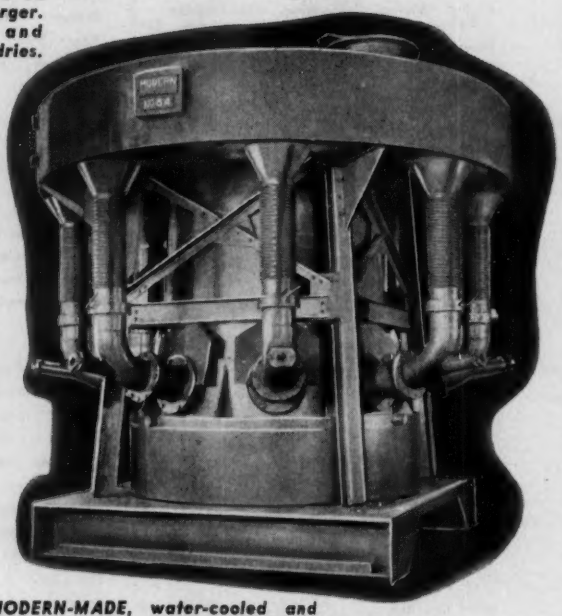

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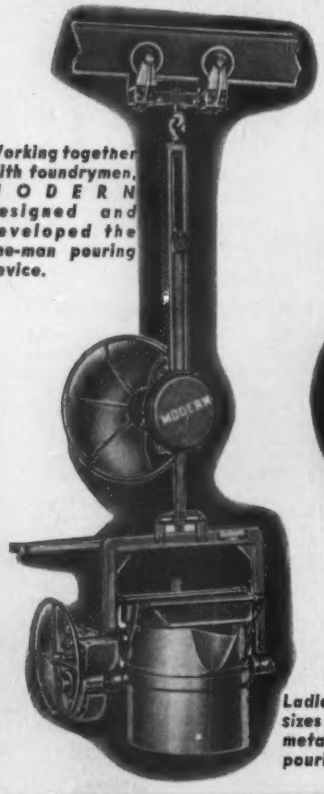

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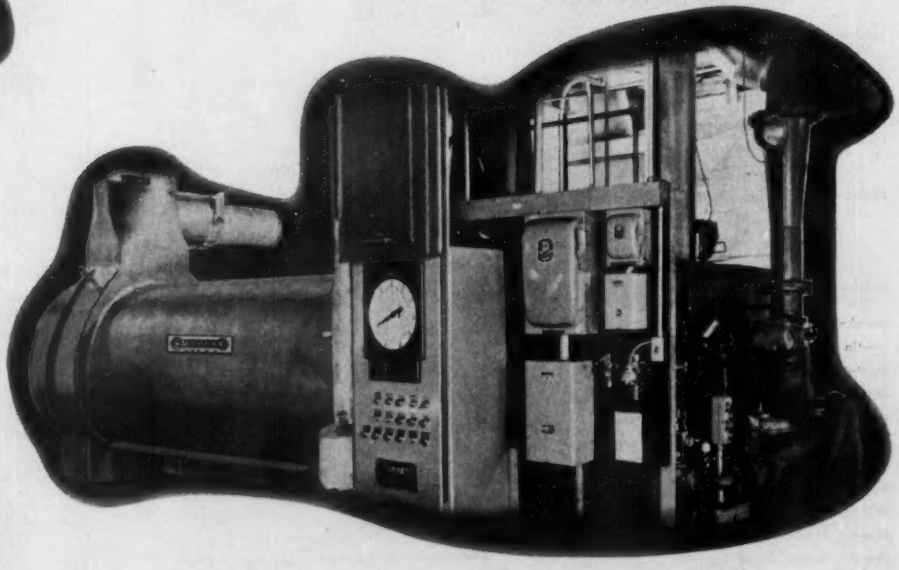

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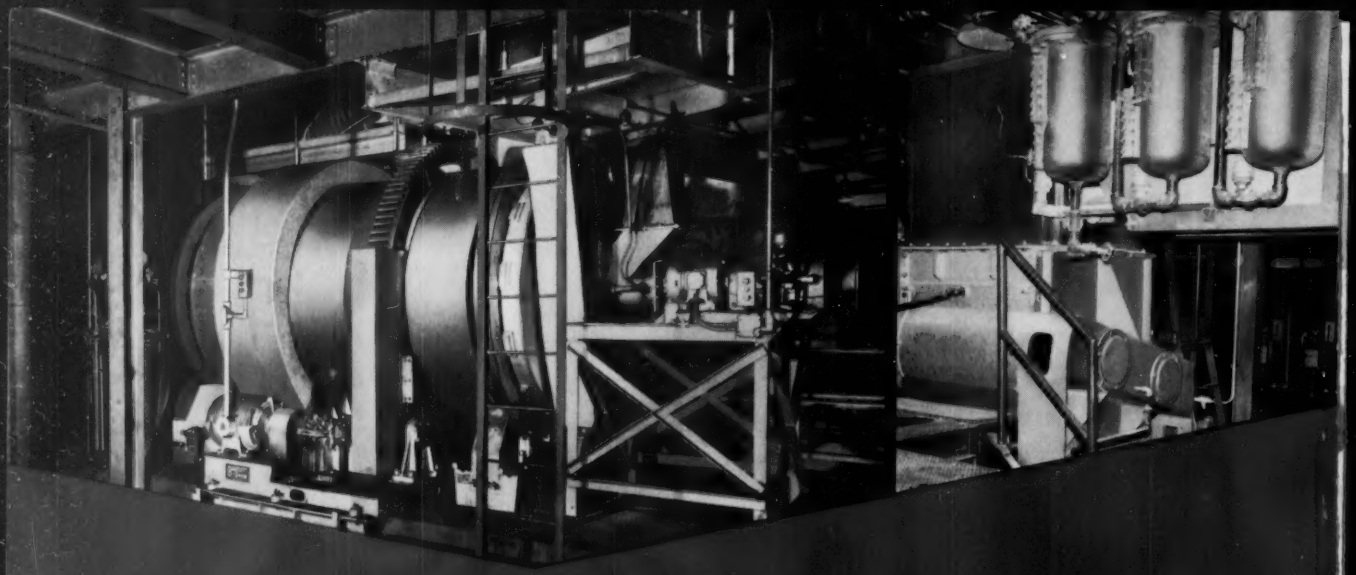

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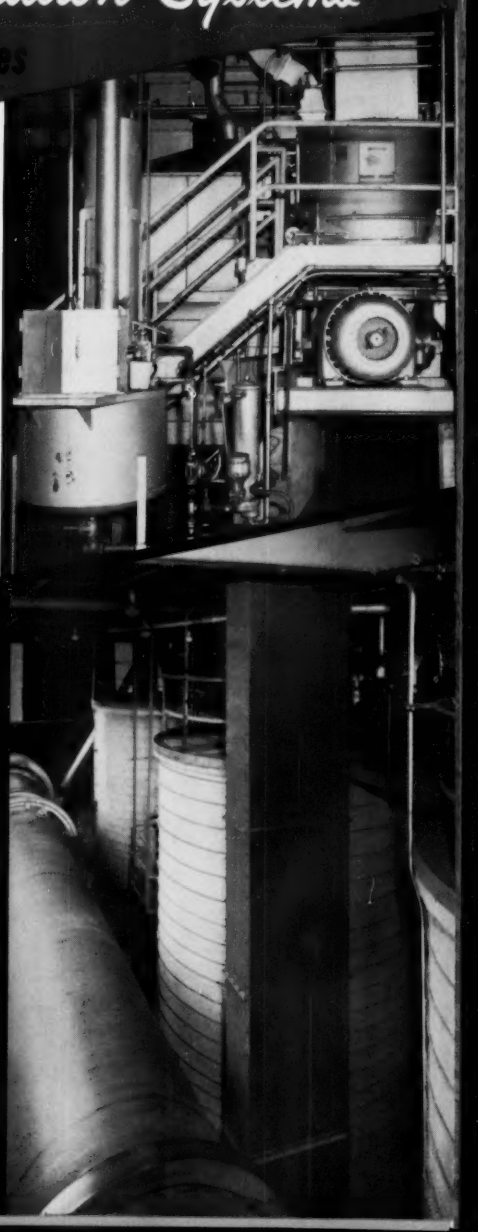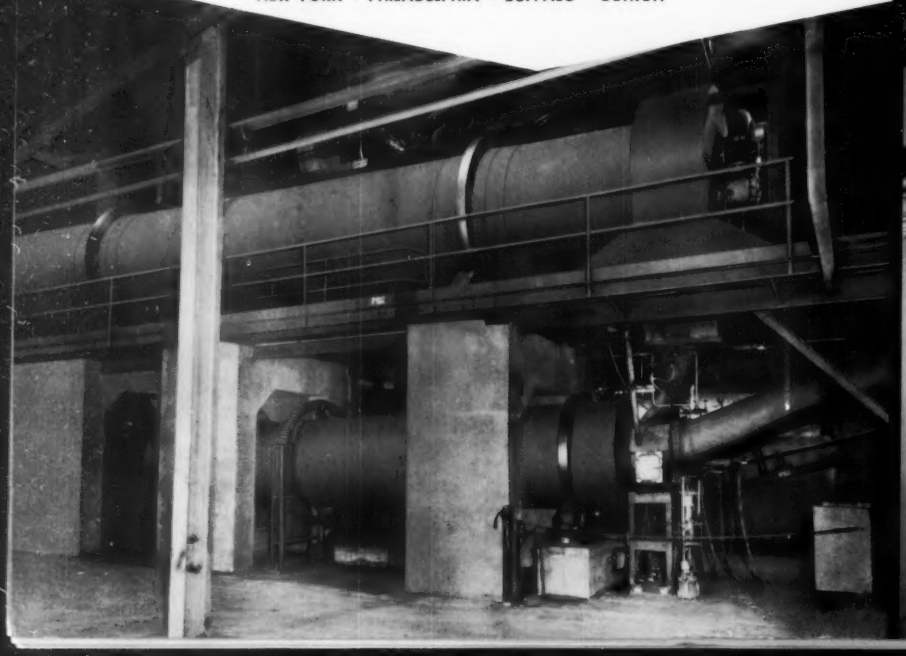
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